

THE RAILWAY GAZETTE

SPECIAL OVERSEAS RAILWAYS NUMBER

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Overseas Railways

BOTH in the weekly section devoted to Overseas Railway Affairs, and in the special articles published from time to time, an outstanding feature of THE RAILWAY GAZETTE is the attention given to overseas railways in addition to recording new developments and discussing problems affecting home railways. The Special Numbers published in previous years dealing specifically with the railways in different countries and continents such as Argentina, India, Africa and Australia, are, as we have reason to know, still frequently referred to. It has been suggested that, in addition to the space devoted in our ordinary weekly issues to overseas railways, THE RAILWAY GAZETTE would be performing a useful service if we published annually a Special Number devoted not to the railways of one particular country or continent, but one devoted entirely to recent progress made by railways in the Dominions, Colonies and other countries, such as Argentina and Brazil, where British-owned railways operate, and to discuss current problems affecting these undertakings. This Special Number of THE RAILWAY GAZETTE is our compliance with that request. It is of course impossible within the compass of one issue, large though it may be, to publish articles dealing with all the British-owned overseas railways, but, as will be seen, an extensive range of typical overseas railways are dealt with in this issue. Other systems which it has not been possible to include this year, we hope to deal with in

future years. We invited a number of the general managers and chief officers of typical overseas railways to send us brief articles setting forth the chief problems affecting their railways during the current year and recording any important and interesting developments which had taken place. These articles and a number of interesting photographs are published in this Special Issue and we venture to think they will be read with particular interest not only at home, but in all those distant parts of the world where THE RAILWAY GAZETTE circulates.

* * * *

Bazaar Trains in India

The vast distances in India between the great centres of commerce have proved an incentive to the extensive use of bazaar train tours in which the coaches, fitted up as travelling shops, are hauled virtually to the doors of potential customers and offer a variety of goods far exceeding the possibilities of the local store. To the Eastern Bengal administration is due credit for the inauguration of these Bazaar Specials, which have now become an annual feature of this system; 30 of the principal broad and metre gauge stations are visited in the course of each tour. Broad gauge trains are naturally used as far as possible by reason of the greater display capacity of their rolling stock, but, during the past year, the Bombay, Baroda & Central India Railway managed to cover a remarkably wide area with its newly introduced metre

gauge Bazaar Special. This train was run by the railway authorities on a tour extending over 112 days and covering approximately 5,000 miles, from Ahmedabad to within 300 miles of Calcutta, and thence back to Indore. The exhibitors on the train were mostly big merchants of Bombay, and the goods sold were almost entirely of Indian manufacture. This train was visited at Delhi by the Viceroy and the Countess of Willingdon, who expressed themselves as being very pleased with this method of encouraging Indian trade by taking manufacturers to the doors of purchasers in various parts of the country. From the railway point of view it was also a profitable undertaking, since the total earnings amounted to about Rs. 40,000 (£3,000).

The Reso Trains of Victoria

Reference is made in our article on the Victorian Government Railways to the Reso tours which have been run in 1934. The name is a contraction of "resources" and is derived from the fact that the inaugural train of this type, which made its first journey in 1922, did so under the name of the Victorian National Resources Development Train. It was the outcome of the realisation on the part of Mr. Harold W. Clapp, Chairman of the Victorian Railways Commissioners, that it was important to demonstrate to leaders of local industry the possibilities of the state. Since then, 22 such tours have been run with a similar object in Victoria, as well as others to Queensland, Western Australia, New South Wales and Central Australia. Each train accommodates 60 passengers, and the six vehicles in the formation are designed to provide a travelling home for patrons and staff, on the lines of the L.N.E.R. Northern Belle cruising train. Although the purpose of the Reso trains is to promote business rather than to provide relaxation, it has been recognised that agreeable surroundings and opportunities for social gatherings are conducive to satisfactory transactions. A handsome observation car and a well-equipped office car are included in the train. Moreover, arrangements are made for the party to inspect representative industrial and agricultural centres, and local authorities at the places of call organise smoking socials where business men can meet and exchange views.

Named Trains in Special Colours

It is generally conceded that a name lends personality to the train to which it is applied, and so earns it a place in the public imagination comparable to that long occupied by the more famous named locomotives. The Railway Department of New South Wales has taken the search for distinction a step further by adopting individual colour schemes for the engines and rolling stock of certain expresses. The first train so treated was the Caves Express. The royal blue selected as the basis of the colouring is made appropriate by the fact that the train runs between Sydney and Mount Victoria, the station for the famous Jenolan Caves in the Blue Mountains. Four other expresses, running on business and holiday services, have also been specially painted, but the allocation to such trains of locomotives coloured in harmony is a more recent development. These engines have also been named, which is a departure from standard practice, but apparently a popular one, since it has lately been extended. The special trains are of uniform design, consisting of six centre-corridor coaches seating 212 passengers in all, with a buffet car for light refreshments. The basic colours chosen, apart from the blue of the Caves Express, are green, red, and brown. Red, yellow, and black have been used for lining.

Victoria: Her Centenary and Railways

World wide interest has been attracted to the State of Victoria, and to Melbourne its capital city, by the centenary celebrations which were opened in October by the Duke of Gloucester and are now in progress. Although the State is but 100 years old, its railway system had its origin just over eighty years ago when, on September 13, 1854, a two-mile line from Flinders Street to Port Melbourne (then called Sandridge) was inaugurated by the Melbourne & Hobson's Bay Railway Company. To-day a Government railway system of over 4,700 miles represents the great contribution of railway transport to the development of the country. Notwithstanding the substantial Government assistance given to private railway companies, they found themselves unable to carry on successfully in a new country where the work of transport was largely developmental. In 1857 legislation was passed authorising the Government to undertake railway construction, and on July 1, 1878, practically the last of the private lines was merged into the State system. Incidentally, the Port Melbourne line of 1854 was the first locomotive line opened (although not the first authorised) on the Australian continent.

Canadian Railway Unification . . .

While all parties are agreed that no useful purpose is served by unrestricted competition between the two great Canadian railway systems, considerable divergence of opinion exists as to what is the best method of co-operation. Mr. E. W. Beatty, Chairman and President of the Canadian Pacific Railway, who favours unification as a solution to the problem of uneconomic running, stated his opinion a week or two ago that there could be no doubt that the maintenance of two independent systems could not, with the greatest possible co-operative action, approach the economies that would be possible through a unification of the management of the two systems. He estimated that unification would result in economies of between \$50,000,000 and \$75,000,000 a year. In a plan for unification, he added, there need be no interference with the ownership of either company, and the net earnings of joint operation of the properties would be allocated in agreed proportions. These remarks were made largely as a reply to Mr. C. P. Fullerton, Chairman of the Board of Trustees of the Canadian National Railways, who is vigorously supporting proposals for co-operative action and no more.

. . . or Co-operation

A large measure of detail co-operation between the two Canadian systems has, in fact, been accomplished already. A good example of this is to be found in the arrangements around Montreal. The main passenger trains from the C.P.R. and C.N.R. stations in that city to Toronto, Ottawa, and Quebec have recently been combined into what is termed a "pool" service. Ottawa trains use, generally, the C.N.R. route; Quebec trains the C.P.R. route; and connections are made to the stations on the other lines. Mr. Fullerton has high hopes that such steps will prove sufficient, and in announcing recently that the net revenues of the Canadian National Railways for the first nine months of the year were \$6,235,000 above those for the same period of 1933, he added that there were definite indications of a general improvement in the Canadian industrial situation, in which the Canadian National Railways had shared. In 1923 the gross revenues of the Canadian National Railways were \$312,000,000; these revenues had greatly fallen off, but now an improve-

ment was being shown. A tremendous reduction in operating expenses had been effected, he added, and if they could get their revenues to \$250,000,000, there would be no further talk about amalgamation.

* * *

Road and Rail in New Zealand

During the past few months work in connection with the licensing of freight services throughout the Dominion has proceeded apace. The railway traffic managers in the various districts collected a mass of evidence relating to the running of competitive services, commodity rates, and traffic densities, and all this information is sifted and weighed by the District Licensing Boards when considering the applications of road operators. Gradually an efficient system of complete control is being worked out, which is designed to prevent uneconomic competition in New Zealand transport. The railway authorities use road transport to no small extent, but an interesting example of economy resulting from merging two government-owned road activities is provided by the arrangement made at the end of last year between the New Zealand Government Railways and the Post and Telegraph Department. The delivery of inward railway parcels in Auckland City, formerly made under contract with private firms on behalf of the railways, was taken over by the Post and Telegraph Department, and, as the latter department has a fleet of large and small vans for the transport of mails, it is able to do the additional work without more vehicles or adding much to the mileage.

* * *

Indemnity Funds for Railway Construction

The work now in progress on the completion of the Canton-Hankow Railway, examples of which are illustrated on page 34, has been materially assisted by the repayment to China in various forms of the Boxer Indemnity Funds. Certain Powers to which indemnity was paid for damage incurred in the Boxer rising agreed that the sum should be returnable to China for the purpose of buying in the creditor country materials for approved purposes to further China's economic development. After the war, therefore, with a gap of 281 miles in the Canton-Hankow Railway still remaining to be filled, negotiations were opened for the return of the British portion of the Boxer Indemnity as an assistance to constructional work. While these formalities were in progress in 1929, the Chinese Ministry of Railways ordered construction to be resumed. The Ministry also secured part of the Belgian Boxer Fund and used it for the purchase of rails, bridges, and certain other material from Belgium for use in building the 51-km. section from Shiuchow to Lochang. Money, however, soon began to run low, and the work, which had been proceeding with a slowness unavoidable in such financial circumstances, at last came to a standstill in the summer of 1932. Salvation came in October from Great Britain, where the negotiations had been concluded and an advance of \$700,000 agreed to, with the proviso that the money should be spent on materials in England.

* * *

South African Main Line Electrification

As long ago as 1903 South Africa gave consideration to the electrification of difficult sections of line carrying a heavy traffic, and after Messrs. Merz and McLellan had submitted a report prepared in 1917-1919, the South African Railways decided to proceed with the electrification of the Durban-Pietermaritzburg line. It is part of the main line from Durban to the Transvaal, and has always carried a heavy traffic, particularly towards the coast, as it forms the outlet for the Natal coalfields, the

centre of which is located at Glencoe. Traffic increased so much in 1919 and 1920 that the question of converting the whole 240 miles from Glencoe to the coast was taken up, as serious congestion existed on the single-track line north of Pietermaritzburg. As the result of a report by the consulting engineers, the S.A.R. administration decided to postpone electrification of the Pietermaritzburg-Durban division and proceed at once with the conversion of the Pietermaritzburg-Glencoe section. The electrical system consists of a 33,000 kW. power station at Colenso (illustrated on page 37), generating three-phase, 50-cycle, 6,600-volt current; an 88,000-volt transmission system; 12 substations converting the high-tension current to d.c. at the line voltage of 3,000; and an overhead contact line from which Metropolitan-Vickers double-bogie locomotives take current through pantographs. Success justified extension of electric traction from Pietermaritzburg to Cato Ridge (inaugurated on February 29, 1932), but depression delayed further conversion until now.

* * *

Central Argentine Widening near Buenos Aires

The first stage in the regrading of the Buenos Aires suburban lines of the Central Argentine Railway, and the quadrupling of the 5½ km. of track between Maldonado Junction and Coghlan Junction, has been completed by the termination of the widening and re-alignment work at the former point. Prior to the reconstruction demanded by the municipal authorities and the exigencies of traffic at one of the busiest points on the company's system, the remaining portion of the existing viaduct, which dated from 1897, and the old Hipodromo station, were demolished. The bridges spanning the Avenida Tiro Federal and the approach road to the municipal yard had to be reconstructed, and a new two-span bridge was required to cross the station approach. A high-level station replaces the old structure. Construction began in 1929, and although a length of some 1.6 km. of double-track electrified line had to be laid, there was no interference with normal suburban and main line services at any time, the new line being brought into service by deviations from the existing tracks. The high-level platforms of the new station are illustrated on page 18.

* * *

Long Welded Rails in Victoria

Economy in many directions has been effected on the Melbourne electric suburban system of the Victorian Government Railways by welding rails into lengths up to 225 ft. An initial saving results from the possibility of re-using the old 100-lb. rails by sawing off the battered ends and welding them together, so that a track almost as good as new is obtained. The reduction in the number of joints causes smoother riding of the rolling stock, which is particularly beneficial in the case of electrical equipment and machinery in addition to economising in maintenance on the vehicles themselves. Electrical conductivity is also improved, resulting in more efficient working. Lastly, passengers benefit by the more comfortable travelling. Welding has been carried out chiefly by the Thermit process, which costs 36s. for each joint in 100- or 110-lb. rail, a figure about 3s. below that for a standard 4-bolt joint bonded for electric traction. This type of joint is, of course, still being used to connect the welded sections. A heavy electric and steam service, with axle-loads rising to 23½ tons maximum for locomotives, passes over the Melbourne suburban system, comprising 325 miles of main track. We illustrate a section showing both welded and non-welded rails on page 44, and reference to the latest progress appears on page 69.

Buy New Equipment Now

FROM one point of view no organisations in the world are conducted with greater massed armies of trained intelligence, with more cohesion and individual efficiency, than are our great railway systems. On the other hand, as old institutions they are, perforce, surrounded with many legacies of the past and other attendant disadvantages. Foremost is the fact that much of their equipment is necessarily old and to decrease the proportion of old to new is the more difficult because of the comparative expense of such equipment. Herein, perhaps, lies the greatest handicap of all railways in combating other methods of transport which compete with entirely new and up-to-date mechanism. This is brought home when one reflects what the competitive and earning powers of railways would be if, by some miracle, all rolling stock, signal equipment and permanent way, &c., could be suddenly transformed into the best that is known to-day. The transformation would be a tremendous revelation and railways as a means of transport would again reign supreme and inviolate in their sphere. That there is efficiency of "input" cannot be denied, but the efficiency of "output" or what might be termed the "over-all commercial efficiency of operating," is a subject of research which we submit should be more carefully examined.

Was there ever a more appropriate time than now to delve deeper into the economics of this question? The cost of new equipment has never been lower since the war, while shops are comparatively empty. During the last few years there has been time for the technical staffs of manufacturers to create, improve and perfect railway equipment of every type and the evidence is that this has been done with virility, originality and success. To philosophise, how many of us have had good service from an old motorcar and on obtaining the new model have been astounded at the advances which have been made? We had not realised how poor the performance had got and had become unconscious of the nursing necessary in starting, acceleration, braking, &c. And so with many locomotives 20 to 30 years old. They haul trains, the carriages are there, but with few people in them because they have gone by road, considering it quicker and more comfortable. The engine which has passed its earning capacity on the main line is relegated to the branch, but is it not more often only to continue its revenue-losing career?

What is the position? The average age of locomotives in Great Britain is probably 20 years, while many important trains are run by engines 25 years old and more. It is probably worse on many overseas railways and we recall an example where 175 engines employed on regular trains are of an average age of 30 years! The first point that occurs to us is the cost of maintenance. This increases with the years, the figure virtually doubling itself in a 20 years' life in many cases. Further, the efficiency and details of design of such locomotives are very far behind what is obtainable and essential to-day. It may well be asked how many locomotives 15 or even 10 years old are really capable of performing economically the intensive work demanded by the modern schedule. It is not perhaps an exaggeration to say that 50 per cent. of the world's locomotives are more or less unsuited to modern conditions, many comparing more favourably with the Rocket than with modern motive power units! Conversely, probably less than 20 per cent. can really be classed as modern locomotives designed for to-day's requirements.

Competition and present world conditions demand powerful and efficient machines capable not only of exert-

ing tractive effort but of furnishing the requisite boiler horse power to maintain that tractive effort continuously. This is the main characteristic of the modern locomotive. The coupled wheels must also be of larger diameter for the faster freight and passenger work required and this reminds us of the many smaller wheeled engines of earlier days still being repaired which in their attempt to keep up with the times turn 20 per cent. more revolutions than necessary—a further adverse effect on service and the road bed, and an increase in maintenance by an amount far more than that indicated by direct proportion.

Another interesting point is the continual "patching" which goes on of old and worn out locomotives that have long since had their day. A certain amount of improvement to 15 or 20-year-old engines is we think legitimate, but is not this "patching" carried on too far on machines which really should be scrapped? For example, to fit a new boiler to such locomotives would by the time it is installed cost, say, some £2,000; in other words, nearly one-third the cost of a new engine, which, in the bargain, carries with it not only new material but the progress of the years in the form of a powerful machine with the correct wheels for the job, adequate boiler power, up-to-date details and fittings capable of efficient output and economical service. We learned recently of one railway converting to superheating no less than 200 engines of an average age of 25 years. This, we think, is a case for complete new engines, the new boilers probably permitting of a better arrangement of superheating. New wine cannot be put into old bottles, and after, say, 20 years the fitting of new boilers in old, tired and crystallised chassis, with ancient appurtenances and accumulated drawbacks, is difficult to justify in the face of the modern demand and to-day's prices.

What is therefore available in this new and modern locomotive? It provides steam at a higher pressure and higher temperature, conveyed to the cylinders through larger steam passages and larger ports and distributed in the cylinders more efficiently by long travel valve gear or valves of the poppet type, and finally exhausted at a lower pressure. The boiler is better designed, makes steam cheaper and has a power commensurate with the tractive power, while the wheel diameter is suitably corrected to enable the locomotive to cope with the demand for faster passenger and freight services. As to the benefits of the latter, the speeding up of goods trains in this country is an example, such having regained a considerable traffic lost to the roads. The fuel and water capacities are also increased to give longer range between compulsory stops. Further, this new locomotive which already, as we see, uses far less coal and water per unit of power at the drawbar, is equipped with the latest fittings, all contributing to the economy and service value of the engine, while the details of the whole locomotive incorporate the combined experience of the railway and manufacturer, eliminating features which in its predecessor have been a deterrent to good service on the road and a continual source of expense in the running shed and shops through the years.

The locomotive of to-day works in a world of different economics from its ancestry. Cleverly planned schemes of allocation and distribution of engine power insist on a more intensive use of the locomotive—it must be capable of greatly increased mileage per month and practically continuous work between shoppings with the utmost economy. Thus we find the characteristics of much of our motive power of 20 to 30 years ago really unsuitable and some would say wholly obsolescent for such service.

Scraping of old engines should be accelerated and the possibility of the immediate acquisition of new power be re-examined, repair cost and suitability rather than age

being the deciding factor. The President of the Institution of Locomotive Engineers recently stated that the saving of $\frac{1}{2}$ lb. of coal per mile on English railways meant £120,000. The modern locomotive would save many times this amount. An eminent American, competent to speak, recently stated that the cost of the investment in a new locomotive can be amortised in 20 years from the saving in cost of repairs alone. It would seem, taking all advantages into consideration, that many new engines would pay for themselves in much less than half this time.

We have elaborated somewhat as regards the locomotive, but the tenor of our theme is applicable to railway equipment generally. As regards rolling stock, the severe effects which road competition have had upon railways have undoubtedly been assisted by the obsolescence of much of our carriage stock. Carriages and wagons have been built to last 30 to 40 years, the result being that an enormous quantity of stock while still capable of running is much out of date for modern requirements, being inefficient and uneconomical. The standard of comfort provided on the railways is often inferior to modern buses and luxury coaches. Seating comfort, lighting and ventilation and the riding of the coach have been greatly improved. Manufacturers have now mastered the steel coach and this is now available stronger and in cases lighter than the wooden, safer in collision and less costly in maintenance. As regards wagons, the cost of replacement of thousands of old wagons which run on railways at home and abroad to-day was never more attractive, the high cost of repairs and poor tare-load ratio rendering them an expensive unit in the present day fast goods train of braked vehicles. The welded wagon with its substantial weight reduction also claims attention.

Travelling by rail is undoubtedly from the public point of view far more comfortable and safer than by road and the transport of goods can be more efficiently done as a whole by the railway than by any other means. We cannot here discuss how such money for modern equipment is to be made available, whether from loans, reserves, renewal funds, depreciation, or even revenue, but we earnestly submit that the case for the speedier modernisation of railway equipment in all countries of the world at this time was never greater, nor an adequate return on the investment surer. Cheap, efficient and economical steam locomotives are available and for special conditions there is the powerful articulated engine perfected in recent years, while for certain shunting and branch line work the compression ignition engine offers an attractive solution and modern carriages and wagons increase revenue and reduce the operating ratio. It is equally so with signalling. The changes therein made on British railways, during the last ten years alone, have effected large economies and led to yet greater safety in operation. The field overseas presents a different problem, as the methods of operation are not alike. The task there is more to raise the standard of equipment in order to accelerate the movement of traffic and to increase efficiency.

The position demands further investigation from the basis that tens of thousands of trains are being operated to-day whose equipment and performance is wholly inadequate, highly expensive and very inefficient. Probed to the depths, many railways who admit that they require new equipment but plead inability to purchase may find themselves in a perfectly sound financial position to embark on such expenditure. In the future there must be a quicker turnover by more intensive usage of railway equipment. Thus will the average age of equipment be reduced, and a step forward towards an adequate return on railway capital be made. Now is the time to buy! In this age we cannot compete or make money with out-of-date appliances.

Safety of Travel in India

FREEDOM from accident for which the railway administration or its servants could be held responsible has in recent years been a feature of the annual reports upon Indian railways. Take, for instance, that widespread 7,000-mile system, the North Western, where, in spite of greatly reduced expenditure upon maintenance and operation, only 11 accidents of all kinds occurred during 1933-34, apart from minor or personal mishaps. In seven of these nothing more serious than slight injuries to passengers or railway servants and damage to property resulted. All the other four accidents took place at level crossings and involved loss of life, for which, however, the railway was by no means always to blame. Though this particular year's record was so satisfactory, showing a diminishing number of casualties under almost all headings, it was not so abnormal in this respect as the following table shows:—

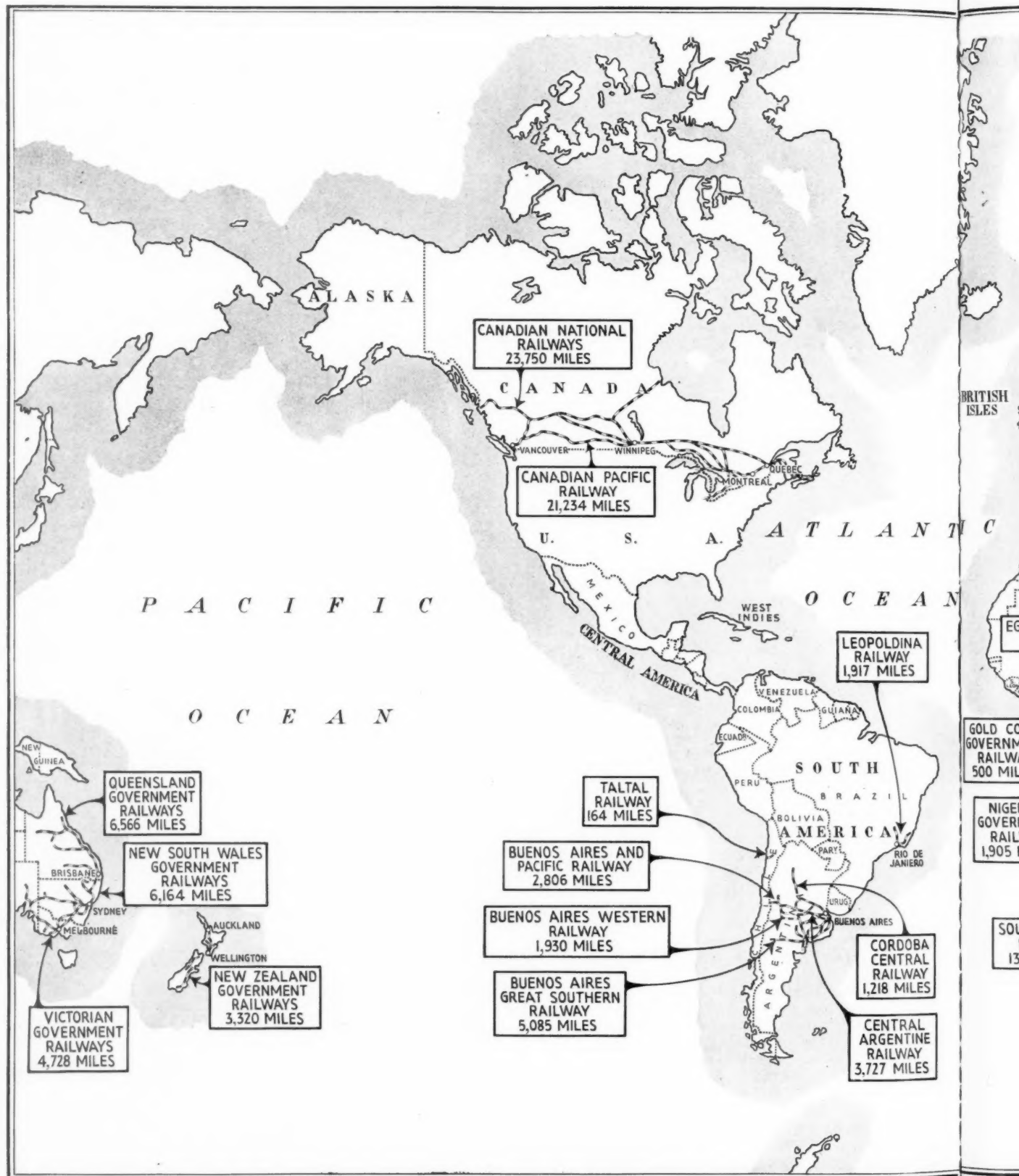
	Four years' average 1929-1933		1933-1934		Increase + or Decrease — in 1933-1934	
	Killed	Injured	Killed	Injured	Killed	Injured
Passengers ...	89	152	60	125	-21	-27
Railway servants ...	56	2,133	35	2,190	-21	+57
Others ...	261	88	292	81	+31	-7

Moreover, what is perhaps even more important is the fact that, of 60 passengers killed last year, no fewer than 42 of these deaths were due to falling or jumping out of moving trains, and another 13 to falling between trains and platforms. Meanwhile, out of 292 deaths of other than passengers or railwaymen, the large number of 229 was due to trespassing and a further 40 on account of alleged suicide. Preventable fatalities were therefore extraordinarily few and, coupled with the rarity of all other kinds of accident, prove to what a high pitch the safety of passengers, railwaymen and the general public alike has been brought on this railway, which may be considered as more or less typical of those throughout India.

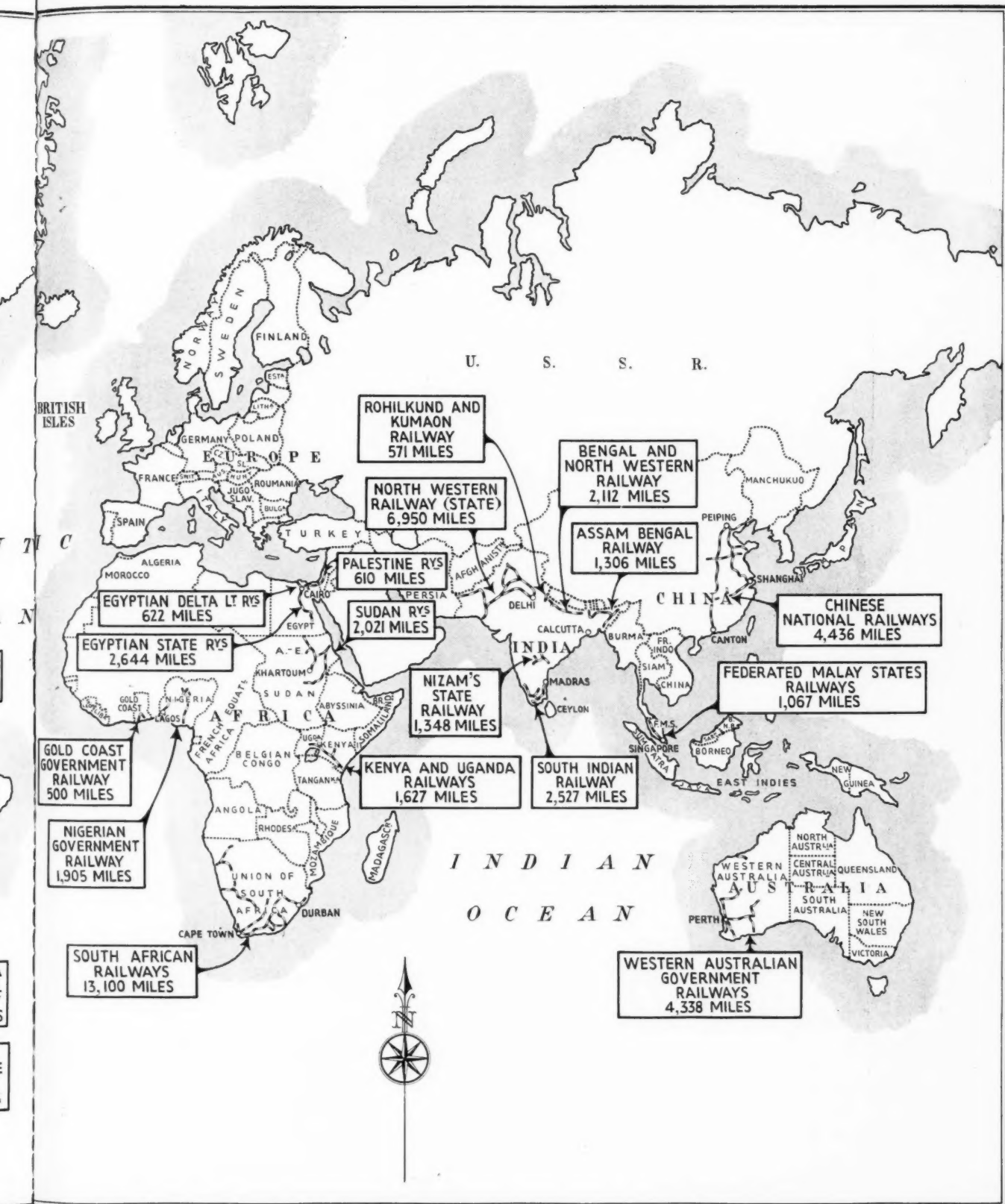
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Gibb Report on East African Railways

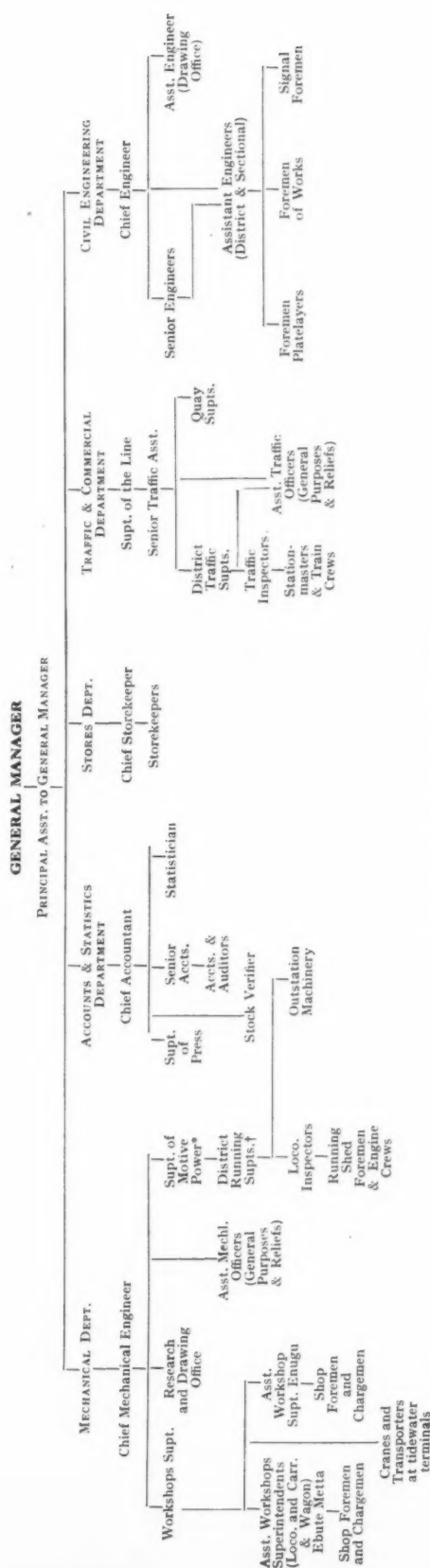
THE Report on Railway Rates and Finance in East Africa by Mr. Roger Gibb, Chairman of the Rhodesia Railway Commission, was published in February, 1933, as the result of an investigation made the previous year. It has received very careful consideration in Kenya, Uganda, and Tanganyika—the three territories concerned—and by the Governors in Conference. Many of its recommendations as to rates have been adopted by the railway administrations, who have found the report of great value in reviewing their rating policy. The considered opinions of the Governors as to the recommendations as a whole have now been received by the Colonial Office, and the conclusions reached on the main suggestions are expected, according to a statement in the House of Commons on November 14 by the Secretary of State for the Colonies, shortly to be published in the form of a despatch. There were proposals in the report to abolish the post of High Commissioner for Transport, to alter the constitution of the Railway Advisory Council, and to appoint a small board in London similar to the board of the Nyasaland Railway. Sir Philip Cunliffe-Lister says definitely that he has found local opinion to be strongly opposed to transferring the responsibility for the railway to a London board, and after full consideration he has come to the conclusion that Mr. Gibb's proposals in this regard are not practicable.



SITUATION AND ROUTE MILEAGE OF TYPICAL OVERSEA



CHAIN OF CONTROL ON THE NIGERIAN RAILWAY AS FROM APRIL 1, 1934



* In consultation with Superintendent of the Line.
† In consultation with District Traffic Superintendents.

DIVISIONAL OR DEPARTMENTAL ORGANISATION FOR OVERSEAS RAILWAYS

Mr. G. V. O. Bulkeley, General Manager, Nigerian Government Railways, explains why the organisation has been changed from Divisional to a modified form of the Departmental system

ONE of the most interesting features of the Annual Report of the Government Railway and Colliery of Nigeria for the financial year ended March 31, 1934, is the Appendix in which Mr. G. V. O. Bulkeley, General Manager, explains why the organisation has been changed from what is known as Divisional to Departmental. As this re-organisation will be of particular interest to many overseas railways, we reprint in full Mr. Bulkeley's comments on this subject:—

At the time of writing, the railway is operating under a Departmental re-organisation introduced as from April 1, 1934. Some explanatory notes are called for. These are not intended to be a destructive criticism of any former organisation. The working arrangements which Crown Colony railways have been able to afford in the more prosperous times of the past, or which have been considered necessary during the periods of their construction and extension, bear no relation to what they now need and can afford to carry.

The re-organisation is based on what the President of the Institution of Mechanical Engineers has termed "the modern trend of co-ordinated and centralised control." Permeating all will be an intensive system of operating and cost statistics, promptly and economically produced by mechanical tabulating and sorting machines, in the Chief Accountant's office, from simple returns rendered by out-stations.

A leading railway authority, Mr. L. F. Loree, who was a member of the Royal Commission which recently investigated the operating and finance of Canadian railways, has said that on railways having not more than six operating districts, the Departmental organisation is the more economical and effective. The Nigerian Railway has three such districts.

It is debateable whether the Transportation (or Divisional) system is really suitable for a Crown Colony railway. That system can fully combine efficiency and economy only in the case of large railways having not only lengthy mileage, but, what is more important as a basis for organisation, large industrial centres located at various points. The constant intense traffic densities in such regional areas may favour the control of both trains and motive power under one divisional officer who has been specially trained for the purpose.

On the other hand, that large railways having high local and overall traffic densities, such as the Great Western of England and the New York Central of the United States of America, still find that the Departmental system meets all their requirements, gives food for thought.

Some Crown Colony railways have a considerable mileage. They have not a constant high traffic density. Their traffics are mainly seasonal. The line is well worked during certain months in the year, but lightly worked for the remainder. These railways are also traversing countries which are still in the pioneer stage where a strong central direction is desirable in all departments of its administration.

On these railways, local conditions preclude a fast train service, and Divisional Superintendents are seldom seen at

headquarters. The Divisions tend to become separate railways rather than parts of a homogeneous whole. Isolated Divisional Superintendents are likely to become autocratic and methods to vary in each Division. The headquarters office of the Transportation Department tends to become one of record and reference, and the benefit of a strong direction therefrom may be lost.

For economical operation, locomotives should move with rhythm. Favourable traffic figures are often discounted by heavy locomotive costs. Where the Traffic Department controls the motive power, there is a natural tendency to draw an engine from the shops, flog it over the line, return it and draw another. This may be costly. It predisposes to engine failures and may defeat itself by calling for an excess of service engines. With the best will in the world, an over-riding traffic system can easily run up the locomotive repair bill. Under such systems, running sheds tend to carry out insufficient repair—neglecting the 'stitch in time'—so that the main workshops may well become congested with heavy "A" repairs and what should be light "B" repairs merge more and more into the "A" category. The constant co-operation of the Chief Traffic Officer and the Chief Mechanical Engineer in regard to train working is all important.

As generally understood, on the extensive railways of North America, where the Transportation system of control was evolved, a General Operating Superintendent and a Superintendent of Motive Power of equal rank, report to a Vice-President for Operation; contact being assured with the Chief Mechanical Engineer at the headquarters workshops, partly by that officer being of equal rank with the Superintendent of Motive Power, and also through the co-ordinating activities of the various Vice-Presidents. Such an organisation would be top heavy for any except very large and heavily worked railway systems.

In contradistinction, the Transportation system, when in force on a smaller railway, eliminates the feature of equal rank outlined in the preceding paragraph, but substitutes no balancing factor for it. This results in the chief traffic officer being technically advised in regard to locomotive running by an officer of lower rank than the chief mechanical authority and in no way responsible to him. However efficient such an officer may be, his position is a difficult one and his advice can too easily be discarded by his senior, the chief traffic officer.

Neither does such a system ensure that the running shed staff are kept up to date, relative to headquarters workshop practice; nor does it keep the Chief Mechanical Engineer in touch with the performance of the locomotives for whose design he is responsible. In effect, the system sets up two independent mechanical authorities. A Crown Colony railway is not large enough to contain these.

After careful consideration, it was decided to adopt the Great Western Railway's running organisation. By the courtesy of the General Manager, Sir James Milne, C.S.I., the Chief Mechanical Engineer of the Nigerian Railway was enabled to spend some time at Swindon, where the Chief Mechanical Engineer of the Great Western

Railway explained to him their working and costing arrangements in regard to locomotive and vehicle running.

Briefly, the re-organisation is as hereunder:—

The abolition of the existing Divisional Transportation system and its replacement by:—

(a) A Traffic and Commercial Department under the Superintendent of the Line. This Department controls the movement of trains with their train crews, stations and station staff, signalling and block regulations, together with all matters concerning the traffic and commercial activities of the railway.

(b) A Running Section of the Mechanical Department under the Chief Mechanical Engineer. This section controls the running of locomotives with their enginemen, together with shed repairs and equipment. The section is in charge of a Superintendent of Motive Power, reporting direct to the Chief Mechanical Engineer on all technical matters, and jointly to him and to the Superintendent of the Line in regard to certain matters which are of common interest and concern, *i.e.*:—

- (i) Allocation and distribution of motive power and rolling stock.
- (ii) Preparation of engine working diagrams in conjunction with train diagrams.

- (iii) Timing and alteration of trains.
- (iv) Examination of enginemen's records.
- (v) Hours of duty for enginemen.

Under this organisation, the Chief Mechanical Engineer functions as his title indicates, and is no longer divorced from the operation of the locomotives and vehicles, which are repaired in his workshops and for whose original design he is responsible. The existence of two separate mechanical authorities within the railway is thus abolished. He is also now in a position to give an annual certificate in respect of all engines and rolling stock. This has not been given in previous years.

The charts herein included show, in general terms, the former organisation and the new. The four largest of the British overseas railways (excluding the Dominions and India) are now operating under the Departmental System; *i.e.*, the Sudan Railways (2,021 miles), the Nigerian Railway (1,905 miles), the Kenya & Uganda Railways (1,627 miles), and the Tanganyika Railway (1,374 miles).

It will be noted that Divisional Accountants have been abolished, and accounting centralised at headquarters. This, together with tabulating and sorting machines, will reduce accounting costs, improve accuracy and provide the executive with prompt statistical data.

DIESEL TRACTION IN ARGENTINA

TWO important pronouncements regarding the future of diesel traction in Argentina were made at the general meetings of British-owned South American railways. Addressing the shareholders of the Buenos Ayres Great Southern Railway on November 7, Sir Follett Holt, the Chairman, said that in view of recent experiments with this form of motive power, it was unlikely that his company would again ship a steam locomotive to Argentina. For six years various avenues likely to lead to economy in working had been explored, and he was able to announce that if a projected branch line from Dolores to Ajó were built, it would probably be the first to be laid out entirely for diesel traction, running sheds and watering stations being dispensed with. The importance of this project lies not so much in the Dolores-Ajó section, which is unattractive commercially but may have to be undertaken under a concession, as in a proposed 15-mile extension to the Atlantic coast. Here the company owns nine square miles of land which lend themselves excellently to being developed into a resort. This would be the nearest seaside town to Buenos Aires on the system, for Quilmes and Punta Lara are on the La Plata estuary and at present the open sea is not touched until Mar del Plata, nearly 250 miles away. Such is the important service it is proposed to develop exclusively with diesel traction.

The effect of diesel locomotives upon reducing the cost of transport has been watched since 1929, when a Beardmore 375-b.h.p. double-bogie diesel-electric unit was introduced. This engine started its career by making a record non-stop run of 775 m. Subsequently it has acquired a reputation for extremely steady running, and an inspection after it had covered 45,000 m. showed that the tool marks were barely obliterated from the flanks of the flanges.

A diesel-electric locomotive put into service on December 4, 1933, has given good results in hauling Bahía Blanca expresses between Buenos Aires and Olavarria. Punctuality is reported to be much superior to that maintained with steam traction, and a schedule allowing only

fifteen minutes for the turn-round at Olavarria has been found practicable. Five mobile power houses are now at work in the Buenos Aires suburban area, where they are operating with great success to a specially accelerated timetable introduced in October, 1933.

The rapid turn-round of these units, for which 5 or 10 min. are allowed as against the 35 to 45 min. for a steam locomotive, is of great advantage on such duties, permitting the running of more trains with fewer engines. The new eight-coach sets for this service were put into running in June-July, 1933, and have come up to expectations in every way. From February 7 this year until the publication of the company's report, one of the power houses was out of service with a broken crank, but prior to that the three units which started working with the new coaches had hauled 53 local trains daily, with a total kilometrage of 1,152. Up to approximately the end of June, these three mobile power houses and the two older units working with them had together covered 737,336 km. since entering regular service.

The development of diesel working has been carried out under the supervision of Sir Brodie Henderson, the company's Consulting Engineer, and Mr. P. C. Saccaggio (Technical Adviser, diesel traction).

Sir Follett Holt again affirmed his faith in diesel power at the meeting of the Buenos Ayres Western Railway on November 14. The company is looking to it to effect a substantial reduction in working costs, and has also had the assistance of Sir Brodie Henderson in planning developments. Road competition has been seriously felt in Argentina, and the Buenos Ayres Western Railway hopes to recapture the traffic lost in outlying districts by providing, at low cost to itself, a rapid and frequent service. Two Armstrong-Whitworth diesel passenger cars are already under trial in Argentina and two further units are due for delivery. It is believed that the economy of operation of such services, as compared with those worked by steam locomotives and trains, will be sufficient to offset the advantages enjoyed by the omnibus operators in the shape of unrestricted rates and hours of labour.

THE AIMS AND ACHIEVEMENT OF COLONIAL RAILWAY ACCOUNTING DEPARTMENTS

By P. H. FORBES,

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A PRIMARY need in economic management is an efficient accounting department, and an efficient accounting department must possess a reliable system, competent supervisors, dependable subordinates, and such modern office machinery and equipment as will enable the financial and statistical returns to be rendered in a prompt and accurate manner. Let us consider how far these requirements have been met in Colonial railway undertakings.

In a general sense, Colonial railway accounts form part of the Colonial Treasury system, which means that all receipts and payments are incorporated in the Colonial Treasurer's monthly accounts, but to some extent this rule has been modified to meet the requirements of those more important "commercial" departments, as railways, which have need of accounts on other than a purely cash basis. A detailed description of the Treasury system would occupy valuable space and serve no useful purpose to those acquainted with Colonial Administration—it is sufficient to say that the system is simple and reliable, having stood the test of centuries in all branches of public finance.

The form in which the final accounts of Colonial railways are prepared is not entirely uniform—there is a variation arising from local conditions—but it is safe to assert that the main classification of earnings and expenditure differs more in name than in substance. The most reliable classification is perhaps laid down by the Ministry of Transport for British railways in the United Kingdom, and its adoption, *mutatis mutandis*, may eventually become a recognised feature of Colonial railway accounting.

The manner in which railway statistics are collated differs widely in Colonial practice, and to attain uniformity a "standard" form has been indicated for general application. The extent to which this can be observed depends upon the mental and material equipment of each organisation, and in particular that of the accounting branches of the railway service.

Colonial railways have so far recruited their supervising officers from home and other important railway systems. In most cases the choice has been satisfactory, and the supply of well-trained recruits is a compliment to British methods. A larger share in the higher responsibilities of supervision is now being undertaken by the more senior subordinates, and there is every indication that this policy will prove successful. The subordinate grades are usually engaged from the local inhabitants, and considerable improvement is shown in the standard of education attained by present applicants.

The Senior Cambridge (School Leaving Certificate) is now the qualification for admission to the higher division clerical service of one Colonial railway, and an ample supply of qualified candidates is convincing evidence of their training and ability. When in the service the progress of these subordinates is marked by a series of departmental examinations, each giving access to higher appointment, and the steady assimilation of advanced accounting procedure is no mean achievement when language difficulties are considered.

The progress of scientific study and invention has lightened the task of accounting officers. Gone are the days of laborious preparation by "hand and head"

method, and in the more important Colonial railways will be found the latest office machinery and devices which reduce "brain fag" to an almost negligible quantity. Among the more important aids to accounting efficiency which they now employ can be mentioned loose leaf ledgers, visible card "ledgers," manifold stationery, duplicating machines, calculating machines of all types, and in the larger establishments punched-card accounting equipment.

To describe the manner in which all these products of inventive genius add to the efficiency of the accounting departments would exceed the limits of this article and exhaust the patience of many who are familiar with their uses, but for those who perhaps are unacquainted with the process known as punched-card accounting, a brief description of its method and achievement will not be out of place. The main equipment comprises three types of machine, (1) the Key Punches, (2) the Sorter, and (3) the Tabulator. By means of the key punches the primary information, extracted from the original documents, is punched on a series of cards, each perforation "cyphering" a figure or letter as the case may be. The cards are then passed through the sorter and "dissected" in the order required. They are then passed through the tabulator which can "post" all dissections in detail, sub-total and grand total. All the machines are driven by electric power units and are capable of extensive and rapid output. The speed of production will naturally depend on the skill attained by the operators, but under proper supervision female personnel can attain a high standard of proficiency. This has been proved by the experience of at least one Colonial railway where the operators have been drawn from a mixed Asiatic community.

Though necessarily brief, this examination of the Colonial railway accounting departments may serve to illustrate in some small way the progress made towards equality with their contemporaries in more highly civilised centres. Apart from the difficulties of language and custom, Colonial railways are situated a long distance from their sources of supply, yet in one important concern known to the writer, a reliable statement of revenue and expenditure can be furnished within the month following the close of each working period. This can be accomplished only by close collaboration with the Crown Agents and diligent study and attention on the part of those engaged in the interesting and useful occupation of railway accounting.

It is hardly necessary to remind them that accountancy is a progressive science adapting itself to the prevailing needs of the people, and that in the columns of THE RAILWAY GAZETTE are recounted the experiences of those engaged in the solution of current problems affecting railways in all parts of the world, supplemented by technical and illustrated descriptions of the latest mechanical aids to accounting efficiency.

Let those who have the interests of railways at heart study those columns and realise the importance of the accounting departments in the scheme of economic management, which is the key to success in every railway undertaking.

THE ARGENTINE RAILWAY SITUATION

Exchange restrictions and road competition have combined with the reduced traffics of the economic crisis to present a serious problem to British railway interests in Argentina

THE Argentine railways' financial year which closed on June 30 last, was unmarked by any important works or new constructions on any of the systems, with the exception of the San Antonio-Bariloche extension of the State Railways, which was completed by the B.A. Great Southern Railway and opened to service in May last. The financial position has compelled all the companies to limit their expenditure, for the time being, to the maintenance of their permanent way, rolling stock and equipment, and such other works as are absolutely indispensable, pending an improvement in the economic situation.

It is useless to attempt to disguise the fact that, at present, the Argentine railways are far from being in a prosperous condition, and the poor returns which, for the past few years, the shareholders in these concerns have received from their investments, are not calculated to make it altogether easy for the companies to raise new capital for the purpose of extending their lines, if and when the situation improves sufficiently to justify them in taking such a step. But while the immediate outlook is by no means as bright as could be wished, it is satisfactory to be able to report that the new financial year has opened under more hopeful aspects than those which marked the beginning of the 1933-34 period. As a result of the crop disaster in North America, caused by the prolonged drought, there is likely to be a good demand for Argentine wheat, maize and linseed, the prices for which have, within the last few weeks, shown marked increases, and all the indications seem to point to a vigorous revival of the Argentine grain export trade in the near future, with beneficial results to the railways as well as to business generally.

But heavy grain traffics alone will not see the railways free of their troubles. Two clouds which still overshadow them are the foreign exchange restrictions and road competition.

Exchange Difficulties

One of the most serious difficulties with which the Argentine railways have to contend at present is the problem of remitting funds to Europe for the payment of dividends and the purchase of materials and equipment, and so long as the present adverse exchange rates remain in force, the drain upon the companies' revenues from this cause cannot be other than very severe. It is estimated that, during the financial year ended June 30 last, the British-owned railways in the Argentine lost millions of pounds on foreign exchange.

Road Competition

The Argentine Government's national road-building scheme, launched a year or two ago, has facilitated the activities of the numerous motor concerns engaged in the transportation of both passengers and goods, and the operation of these services has made serious inroads on the main line and suburban receipts of the railway companies.

In endeavouring to combat the menace of road competition, each company has attacked the problem along the lines likely to be most effective from the standpoint of its own particular interests, either by the operation of motor omnibuses or railcars, or running motor lorries for

the transportation of cereals and other goods traffic in those outside zones where road competition is most intense.

Reduced Traffic Receipts

Traffic receipts—both passenger and goods—on nearly all the Argentine railways suffered an extremely sharp drop during the financial period 1933-34. Various causes contributed to this state of affairs. Due to the decline in international grain values, growers were holding over their stocks, in the hope of obtaining better prices for their produce, with the result that, for some months, the cereal movement over most of the lines shrunk to very small proportions, while at the same time warehouses and railway sheds contained large stocks of wheat, maize and linseed, awaiting transportation.

In November last, the Government determined to come to the aid of the agricultural community by creating a Grain Regulating Board for the fixing of grain prices, in order to guarantee the growers a fair return. This had the effect of giving an impetus to the grain movement, which began to be reflected in the weekly traffic receipts which, from February onwards, commenced to show a slightly upward trend, as compared with those for the corresponding period of the previous year. Although this improvement was more or less maintained during the succeeding weeks, at the end of the financial year on June 30, the only two broad-gauge companies whose gross traffic returns showed increases over the previous financial period were the B.A. and Pacific (£109,000) and B.A. Western (£9,000); the B.A.G.S. having a gross deficit of £42,000, and the Central Argentine one of £376,000.

Due to the general business depression, passenger movement over most of the lines also declined very considerably. With a view to recapturing some of this lost traffic and at the same time encouraging tourist travel, some of the companies have given greatly increased facilities by establishing specially reduced rates for excursion trains, whilst others have established shopping and week-end tickets. These special facilities gave a much-needed impulse to passenger movement, and were widely availed of by large numbers of people who might not have been able to afford the ordinary fares.

Working Expenses and Wage Reductions

As an offset in some measure to the serious fall in their traffic receipts, all the companies have made strenuous efforts to reduce working expenses to the lowest possible figure compatible with safety and efficiency, and it is very difficult to see what more can be done in this direction, having regard to the fact that, in some cases, as much as three-fourths of the total expenditure corresponds to salaries and wages, which, it should be pointed out, have been fixed after agreements ratified between the Government, the companies and the labour unions.

As a result of the necessity for exercising the strictest economy, and the enforced suspension or postponement of all large construction schemes, most of the companies have large numbers of surplus men on their hands. The railway labour regulations at present in force were established by Government decree some years ago, when the railways were enjoying a period of comparative prosperity,

which enabled them to bear heavy additions to their wage bills without serious loss. To-day, however, the position is entirely different, the monthly wage-bills which all the companies have to meet being in most cases out of all proportion to their receipts or the amount of work which has to be carried out. In view of the prevailing unemployment in the country, as a result of the general business depression, the Government is averse from swelling the ranks of the workless with some hundreds of discharged railwaymen, for which reason the railways are obliged to maintain in service an excessive number of men, who could easily be dispensed with.

By way of compromise, a scheme of wage reductions was agreed to between the companies and the unions, on the "short time" principle, involving a *pro rata* reduction in the number of days worked, on the basis of the annual gross receipts. Although this arrangement resulted in a reduction in the working expenses, it proved quite inadequate to offset the decline in revenue.

Government Transport Commission

In April last, the Argentine Government acceded to a joint appeal addressed to it by all the railways in

the country, by appointing a special committee, representative of the State and foreign-owned railways, the Argentine Industrial Union, the Stock Exchange and the Argentine Rural Society, to study and report on the conditions under which the national transport services are at present operating, with special reference to the economic situation of the railways, and arrive at some scheme of transport co-ordination, in order to eliminate the existing duplication of services and injurious competition. The precise method of procedure to be followed is not yet known, but it is presumed that the enquiry will be conducted along lines more or less similar to those of a Royal Commission in the United Kingdom, evidence being called for and witnesses examined.

Whatever the outcome of the commission's investigations may be, it is satisfactory to learn that the financial position of the Argentine railways is at last to be the subject of an official enquiry, which it is hoped will clear up many popular misconceptions in regard to their earnings and profits, and at the same time pave the way for the removal of some, at least, of the serious disabilities under which the companies are at present forced to operate.

BUENOS AYRES AND PACIFIC RAILWAY

ALTHOUGH there would appear to be some slight signs of improvement in the general situation, this tendency to recovery can hardly put the railways on their feet financially, and until a return to better trade takes place no new developments or extensions can be considered. Therefore, the activities of this railway, for some time past, have been limited to the maintenance and upkeep of existing tracks, rolling stock and workshops.

The greatly increased road competition has caused, and is still causing, a decided falling off in passenger receipts, especially in the suburban districts of the principal cities of this system, and local goods services have suffered also. As a means of combating this intense competition, studies have been made with the idea of replacing steam services by light railcars and trailers, operating at frequent intervals at economical rates. These matters are still under consideration.

On the main line, with the exception of running excursion trains, no attempt has been made, so far, to alter existing conditions, but both passenger and goods services have been speeded up. On branch lines, rail omnibuses are being introduced to replace the present steam system, as well as for additional services. Two such vehicles have already been constructed and placed in service, with satisfactory results in the districts over which they operate. Schemes are under consideration for the provision of additional vehicles equipped with compression ignition engines and hydraulic transmission, which will operate at speeds up to 100 km.p.h.

It is anticipated that, by the institution of an extensive railcar service on branch lines, the operating results will be reduced and, at the same time, an attractive service will be offered to the public, not only from the point of view of comfort, but also of increased frequency and higher speeds, coupled with, what is perhaps more important still, a reduced fare.

This company has two rail lorries for parcels and goods services at present in use. Rail lorries have been utilised to carry milk traffic on sections of line where the train services are unsuitable for the conveyance of this class of traffic. Reductions in goods rates have been made.

In order to encourage tourist travel a start has been

made by running a luxury cruising train comprising Pullman, sleeping and bath cars, hairdressing saloon and writing-room, and a car equipped with radio and orchestra for dancing. Special excursion trains are run periodically also between Buenos Aires and important towns, and arrangements are in force whereby passengers can obtain through tickets, inclusive of hotel charges, to various pleasure and health resorts.

Although no road services are directly operated by the Pacific Railway, it has a working agreement with a subsidiary road transport undertaking which acts as a feeder for both passenger and goods services.

A bill for the co-ordination of all classes of transport is before Congress. Should it become law, the effects may prove to be decidedly beneficial to railway interests, as road transport companies would be obliged to conform to regulations similar to those imposed on rail services. A Government department will control tariffs, rates of pay and conditions of working. At the instigation of Sir Follett Holt, the President of the Republic has appointed a special commission to report on the financial situation of the Argentine railways, and to submit recommendations which will bring about a closer understanding of the railway problems vis-a-vis the general interests of the country. This investigation is to cover the transport problem as a whole, and presumably, will deal with the co-ordination of the railway services with the other methods of transportation in order to avoid duplication and ruinous competition.

Though the railways have been able to obtain sterling exchange for essential stores, they are very severely rationed in respect to the monies which they require to remit to meet financial obligations in London. The amounts available for remittance are accumulating, although some relief was given when the Roca Treaty came into force. Even when exchange is secured, the premium that has to be paid to obtain sterling represents a very serious loss to the company, so that even if traffics improve very materially, unless there is a corresponding improvement in the rate of exchange, the British companies operating in Argentina will be labouring under serious financial disabilities.

BUENOS AYRES WESTERN RAILWAY

By developing railcar services to supply the peculiar requirements of its territory, and by revising its maintenance organisation to promote economy, this system is preparing to profit by the industrial development of which signs are already visible in Argentina

IN common with all other railways in Argentina the Buenos Ayres Western Railway is dependent upon the transport of agricultural and pastoral products and the general merchandise bought with the profits of their sale for its livelihood; it is, therefore, not to be wondered at that the Western has suffered considerable reductions in its traffic receipts during this period of crisis when unremunerative prices have been obtained for the country's produce.

Owing to the privileged position of Argentina with regard to its climate and wonderful soil, production costs for cereals and cattle are low and their quality cannot be surpassed, but in spite of this, the prices ruling until recent months have, in most cases, been under cost, and therefore, apart from goods for export, no traffics other than those for the absolute necessities of life have been offering.

Discovery of Stone

Situated as it is, for the most part, on a vast alluvial plain, the territory occupied by the Buenos Ayres Western Railway is practically devoid of stone. Even now, it would be possible to draw a plough through this richly productive soil for more than 800 kilometres westward of Buenos Aires before turning a single pebble.

The discovery and opening up of the Lonco-Vaca stone quarry near Casimiro Gomez, 652 kilometres from the capital, has provided the company, therefore, with a new and important source of income in the transport of material for road building and general construction purposes, besides reducing considerably the cost of stone for track ballasting. Previously, these works were exceptionally expensive, as freighting charges for stone from other sources generally exceeded the cost of the stone itself.

Start of a Tomato Industry

Following the Government application of import duties on tomato extract, an entirely new industry has come into being at Colonia Alvear. The irrigated soil of the colony surrounding the town, which is 900 kilometres from Buenos Aires, is so eminently suited to the growth of tomatoes that full advantage of the opportunities offered by protection have been taken, as is shown by the construction of five canning factories, and the planting of no less than 8,600 acres of this fruit alone.

Diesel Railcars

Up to recent years, an infrequent service of steam trains was all sufficing to supply the demands of the sparse population, widely spread over large tracts of country, especially when the only other means of transport was by horse or horse drawn vehicles. The use of the motor car was slow in reaching the far off parts served by the railway, as the tracks (roads, they certainly were not) were for the greater part of the year impassable. The improved state of the country roads is responsible for the railways losing traffic they once possessed, and if they are to maintain their position, the introduction of better facilities to encourage railway travel is essential.

Owing to the sparsity of the population the running

of frequent steam trains is out of the question, and cheaper and less cumbersome units are indicated. The comfort given to the passengers must be comparable with that of the modern motorcar and indeed improved upon. With this end in view, the Western Railway is trying out three different types of diesel-electric railcars, with the ultimate aim of replacing the majority of the existing steam trains on all branch lines and of putting in as frequent a service of small units as traffic will warrant.

Orders for two diesel-electric railbuses to the rather unusual design of the Consulting Engineers, Messrs. Livesey & Henderson, have already been placed with the Birmingham Railway Carriage & Wagon Company. These vehicles will be powered by Gardner 140 h.p. diesel engines to give cruising speed under all conditions of 60 miles an hour. They will be air-conditioned, and will have reversible arm-chairs based on aeroplane design, to provide comfortable accommodation for 20 passengers, and 5 tons of market produce and parcels.

These two units have been designed to cater for the most sparsely populated districts. They will be economical to run, and will have a sufficient capacity for carrying market produce to encourage the farmers to change from being purely dependent on cereal crops and to devote their energies to mixed farming, which, to-day, is in its infancy in Argentina. These railcars will connect with existing steam services, so that the extra tonnage produced will then be carried at a very small extra cost to the railway.

Two other railcars are being supplied by Messrs. Armstrong-Whitworth & Co. Ltd. One consists of a two coach unit driven by a 450 h.p. Sulzer diesel engine, which provides sufficient reserve power for two extra trailers if desired. The second is a diesel railbus powered by a 122 h.p. Armstrong-Saurer diesel engine, with accommodation for 57 passengers, similar in design to those running so successfully on the L.N.E.R. These units are intended principally to replace the more expensive steam trains running in the outer suburbs.

Track Maintenance—Change of Method

Prior to the year 1930, track maintenance was effected by small permanent gangs stationed at close intervals all over the system, pump trolleys being the standard method of transport from gang headquarters to the work on hand.

The crisis forced the takings of drastic measures to reduce to a minimum the number of men engaged on the track, resulting in practically all the permanent way huts being abolished and much larger gangs established to work under the orders of the highest class of track foremen, and to facilitate the movement of men, &c., internal combustion motor trolleys have been provided.

The careful pre-arranged programming of the work to be done and the much improved supervision and mobility due to the use of the motor trolleys has revolutionised the methods of carrying out track maintenance work which were the common practice so few years ago.

General Outlook

Should the present prices of the products of the country be maintained the future of the Western Railway need cause no anxiety to the owners, as in spite of

reductions in receipts, losses on exchange (which last year amounted to no less than £260,000) during the most severe crisis in the history of the railway, its actual expenses have been covered.

The crisis has had the effect of teaching economy, not only on the railway, but to the producers of the country themselves, so that a continuance of present improved prices will not only bring Argentina back to prosperity but should lead to still better conditions in the future. The higher prices now ruling for the country's products will have an immediate effect on local industry, as the

cost of production has reached a point which few agricultural countries producing for export can touch. Once the country comes back to normal the exchange difficulties will be minimised, and sufficient traffic will be offering to justify fully the inversion of the capital of the railway.

The capacity of the Argentine Republic is realised by few. The country could comfortably accommodate a population of five times that of the present, and still be sparsely populated. Not until that day arrives, and the railways then fail to return interest on the capital invested, should pessimism about the future be justified.

TRANSPORT OF MILK IN ARGENTINA

The Buenos Ayres Great Southern Railway has forestalled road competitors by providing Thermos-tank wagons to transport the pasteurised milk of an important dairy

IN pursuance of its policy of providing the best possible service, the Buenos Ayres Great Southern Railway has not relaxed its efforts to keep its methods and equipment up to date in every respect. Apart from successful experiments in diesel-electric traction, during the past few years a great deal of attention has been given to the problems arising from road competition. The use of motor-lorries for the carriage of general merchandise tends to increase throughout the Argentine Republic, and the railways have felt this competition very keenly, especially over short distances in the neighbourhood of Buenos Aires.

The milk traffic is very specially exposed to this competition. In the area around Buenos Aires until recent years, the production of the dairy farms was sent in by rail to the city and its suburbs, or to the dairy companies' factories situated at convenient distances from the city, where milk for consumption is pasteurised and cream is prepared for butter making. In 1929, however, motor-lorries commenced to cater for this traffic and met with a certain amount of success in distances up to 40 kilometres from Buenos Aires. These road transport concerns have subsequently extended their activities and are now operating as far out as 70 kilometres from the city. The milk traffic despatched from stations on the railway amounted to 133,000 tons during the year to June 30, 1934.

The retention by the railway of the greater part of its milk traffic, as against the facilities and cheapness of road transport, has only been possible by the introduction from time to time of special rebates on wagon loads or important monthly or yearly tonnages. This measure had the desired effect in areas where paved roads had not penetrated, but the construction in 1932-33 of a concrete highway from the suburb of Temperley, which was already linked to Buenos Aires by a paved road, to Cañuelas (64 kilometres from the city), alongside the railway line, and through a district where there are numerous dairy farms, threatened the railway with an almost total loss of the milk traffic.

La Martona factory despatches some 25,000 tons of pasteurised milk per annum, in 50-litre cans, while the small dairy farmers still use small cans of tapering shape, designed for carrying milk in panniers on horseback. Faced with the possibility that La Martona company might elect to transport its pasteurised milk in tank-lorries from Vicente Casanes to its bottling plant in Buenos Aires, the railway offered to provide Thermos-tank-wagons for the service. Apart from the economy of handling, the use of these vehicles represents a considerable saving in freights because of the elimination of the container (milk-can), chargeable at the same rate as its contents.

La Martona company fell in with the proposal, and recently two of these Thermos-tank-wagons have been put

into service, built by Thompson Bros., Bilston, Staffs, England, and others are under construction. Their design is as simple as can be devised. Upon the under-frame of a 40-ton flat wagon, 34 ft. long, a covered vehicle has been constructed containing two 10-ton Thermos-tanks at each end, with a space between in which cream cans and butter boxes can be loaded to make up a total maximum load of 30 tons. The Thermos-tanks, of cylindrical shape with convex ends, are of stainless steel insulated with cork packing, and are provided with man-holes for cleaning purposes, glass inspection windows, inlets for compressed air with the necessary gauges and fixed thermometers indicating the temperature of the milk. The milk is loaded at a temperature of 3° Centigrade (37.4° Fahrenheit), and even in summer does not lose more than 2° to 3° C. in transit, thus ensuring perfect freedom from bacilli. On arrival at Plaza Constitucion the milk is discharged by air pressure to glass-lined tanks mounted upon motor-lorries and taken to the bottling plant.

Although this service has only recently been inaugurated, it has proved so successful that the construction of additional Thermos-tank-wagons is a distinct possibility. The extension of this method of transport to milk sent from the smaller dairy farms presents certain difficulties which so far have precluded the possibility of the use of Thermos-tank-wagons. The daily production of each farm is as a general rule too small to enable the railway to provide Thermos-tanks for individual farmers, and, even if this were to be done, the lack of cooling and pasteurising plants contiguous to the railway stations would render it impossible to make use of Thermos-tanks of the type adopted for La Martona traffic, while lack of pasteurising and bottling facilities in Buenos Aires or the suburbs would prevent the use of simple tanks filled by hand.

The dairy farmers, however, have recently discovered that by combining themselves into Co-operative Societies they can obtain better prices for their produce, and, in consequence, organisations of this nature are being formed throughout the dairy farming districts. It is hoped that when these concerns have consolidated their position they will establish their own marketing organisations in the capital and suburbs, and construct cooling plants at the despatching and bottling plants near the receiving stations, thus enabling them to take advantage of the economical method of transport obtainable through the use of Thermos-tank-wagons. The experience of La Martona in that direction is being eagerly watched by the dairy farmers as a whole, and no doubt when they have fully assimilated the advantages to be derived from the use of Thermos tanks they will endeavour to place themselves in a position to use them, thus ensuring their traffic to the railway.

CORDOBA CENTRAL RAILWAY

A review of improvements instituted in the locomotive and permanent way departments during the past year in order to secure more efficient working with decreased expenditure

DURING the past financial year, no new machinery or rolling stock has been put into service, with the exception of two new steel first class carriages with a seating capacity for 70 passengers, which were acquired in 1929 and have been stored in the workshops pending an opportune moment to utilise them; these are now running on the local Buenos Aires passenger section.

In view of the pressing necessity for economy, the locomotive workshops have made a steady progress in the development of scrap material. In the smithy shop 427 tons of scrap iron have been converted into 59,726 finished parts; 40 tons of old boiler tubes, unfit for further boiler use, were flattened out, and from these were obtained 4 tons of iron washers, 2 tons of cotters; the remainder of the material was used for pipe clips, liners and supports.

Notable progress has been made in the use of electric welding throughout the locomotive workshops, principally in firebox repairs. Some 10 years ago a small start was made with one welding set; that number has now been increased to 10. All main line passenger and several heavy goods type locomotives have their tubes electrically welded to the tube plate. Some years ago tube failures gave a great deal of trouble, but thanks to tube welding these have been practically eliminated; in fact, one locomotive ran 150,000 kilometres between shoppings without having the tubes touched. Welding of steel fireboxes has also had special attention. Fireboxes with large stay bolt holes have the wrapper plate cut out and a new plate soldered in. Steel boxes, as a rule, generally give out in the bottom part; in such cases half boxes are welded in. All fireboxes have seamless corners in the fire line.

Garratt locomotives have done yeoman service on the railway's most difficult grades, hauling 50 wagons totalling 1,750 tons. A record long distance run of 449.5 miles was made during the year with a Mikado type of locomotive, hauling a special passenger train composed of 10 vehicles, weighing 272 tons, the average speed over the entire run being 33.4 m.p.h., which is a remarkable achievement with 4 ft. 4 in. driving wheels.

At one of the principal running sheds a water treating plant has been installed which treats 500 tons of water a day. Previous to the advent of this plant, tube and stay leakage was very prolific, and the cracks which developed in the firebox sheets were alarmingly numerous. The treating plant has been the panacea for all these evils and to-day the company is free from such difficulties. As a consequence of the benefits thereby derived, the number of locomotives allocated to this depot was reduced by 40 per cent. The tubes changed have been reduced by 82 per cent. and the staff has been cut down.

The bad quality of the water employed for locomotive purposes may be gauged from the fact that previously it was necessary to take the engines out of service after 9,000 miles had been run and withdraw all the tubes for the purpose of removing the deposit of incrustation; this practice is no longer necessary, and locomotives have completed over 62,000 miles without the removal of a tube!

A high standard of maintenance of the permanent way is necessary on account of the running of fast fruit and vegetable trains from the north to Buenos Aires, a distance of 1,268 kilometres, but owing to strict economy having had to be exercised on account of the prevailing commercial depression, it was exceedingly difficult to attain

this standard. A solution of the problem, however, was found in the adoption of a system of partial ballasting carried out as part of the ordinary maintenance. Crushed, but not screened, stone was loaded into hopper wagons and transported on the ordinary goods trains for an average distance of 280 miles. When nearing destination, the wagons were transferred to shunting trains which were slowed down to enable the wagons to be discharged. This work, and the placing of the stone, was done by the ordinary gangs reinforced. A depth of 6 in. below the bottom of the sleepers was adopted in place of the standard depth of 10 in. and this has proved adequate. During the last three years some 75 miles of track have been ballasted in this way and the result has been entirely satisfactory, while the expenditure has hardly been felt.

The general standard of the track has improved, fast and heavy traffic has been carried without difficulty, and maintenance expenditure has been reduced to a figure which, including the cost of the ballasting, is considerably less than that of two years ago for maintenance only.

On one busy section in the north, the renewal of track, which had been started in 1928, had been left in suspense for economic reasons. As a result of this suspension, the joints became worn and battered to an extent that necessitated the slowing up of trains, and breakages of springs increased. In view of this, it was decided to ballast 60 miles of this track and to add special supports at the joints. Fifteen thousand of these supports were stamped from scrap material in the company's shops. The result was so satisfactory that the railway was able to speed up its passenger service and compete with road transport.

Over a large stretch of the line sleeper renewals had got into arrears to an extent which made it imperative to proceed with the work, and about 250,000 hardwood (quebracho colorado) sleepers were put into the track. On the other hand, the life of the sleepers has been prolonged considerably by the use of a device invented and patented by an employee in the Engineering Department. This consists of a shim, or supplement, used with the dog-spikes when redriven, to avoid boring a new hole. The shim is so contrived that it is drawn into the hole as the spike is driven in, producing a tight fit.

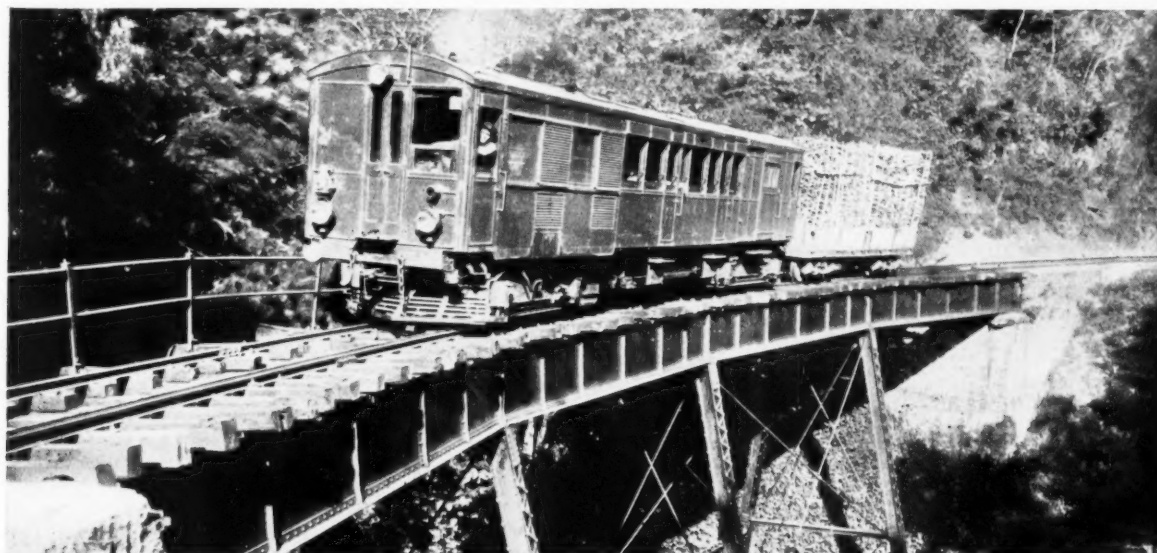
Unavoidable postponement of renewals has made it necessary to adopt special measures to prolong the life of the old track material. It was found that fishplates produced in the company's workshops under the drop stamps and given a considerable camber to take up the wear, could be used with the old rails with excellent result. The railway is now installing additional drop stamps in order to increase the output of fishplates and joint supports. In addition to taking up the wear, these stamped fishplates are so designed that they enable the sleepers at the joint of the rail to be placed closer together, thereby giving better support, and for this reason the stamped fishplates have been found to be superior to the tapered shims, which have been used much less widely.

During the present year, it is expected to instal a 30-cwt. drop hammer, a trimming press and a universal milling machine, and when these are put into operation the company should be able to manufacture additional permanent way material at economical cost. Several new steel passenger coaches will be put into the Buenos Aires local service during the present financial year.

TYPICAL SCENES ON OVERSEAS RAILWAYS



The Central Argentine Railway train Panamericano about to leave Retiro station. Buenos Aires, on its northward journey, which constitutes the first link in the diagonal transcontinental route between Buenos Aires, Lake Titicaca, and the Pacific coast in Northern Chile and Peru



A 200 b.h.p. Beardmore diesel-electric railcar and wagon on the Venezuela Central Railway



Existing signals converted to British Power automatic signalling on the Buenos Aires electrified suburban lines of the Central Argentine Railway. The view also shows the protected conductor rails, and, on the left hand, a level crossing warning



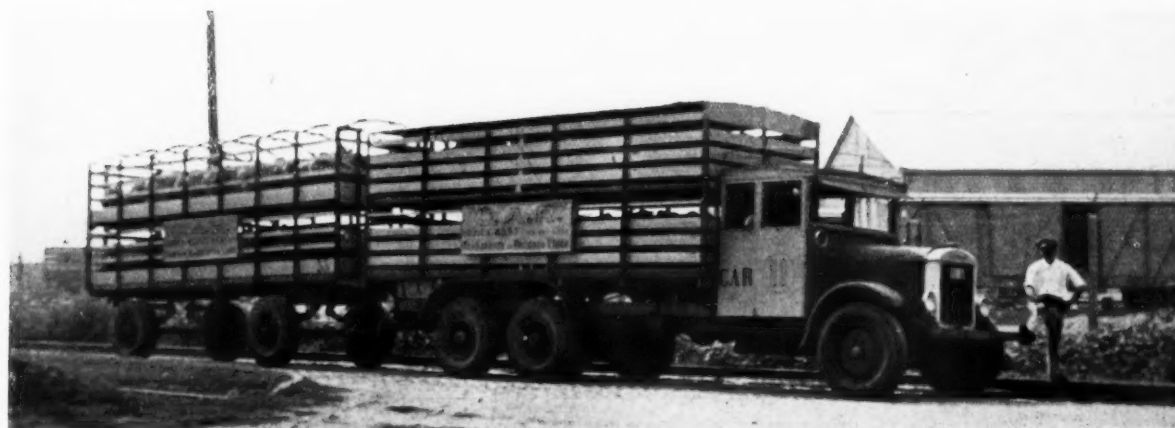
Central Argentine Railway widening at Maldonado Junction, showing new bridge over Avenida Alvear and footwalk between main girders



Thermos-tank wagon built by Thompson Bros., Bilston, Staffs, for milk traffic on the Buenos Ayres Great Southern Railway. Milk is transferred by compressed air to the lorry in the foreground (see article on page 15)



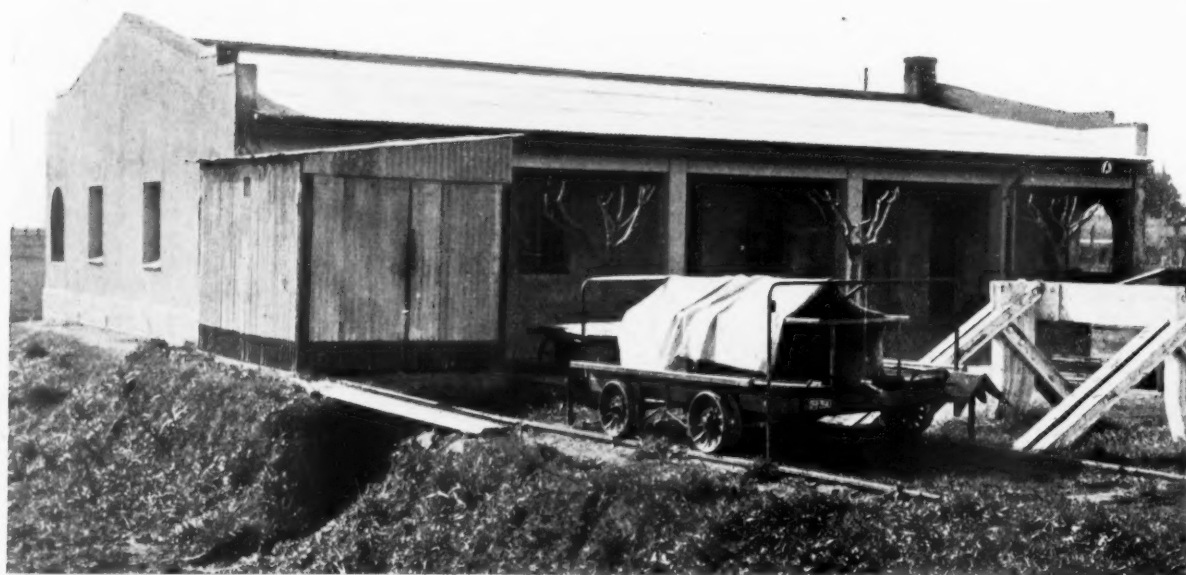
Left, loading a Thermos-tank wagon at Viente Casanes ; right, another view of transferring milk from wagon to lorry at Plaza Constitucion



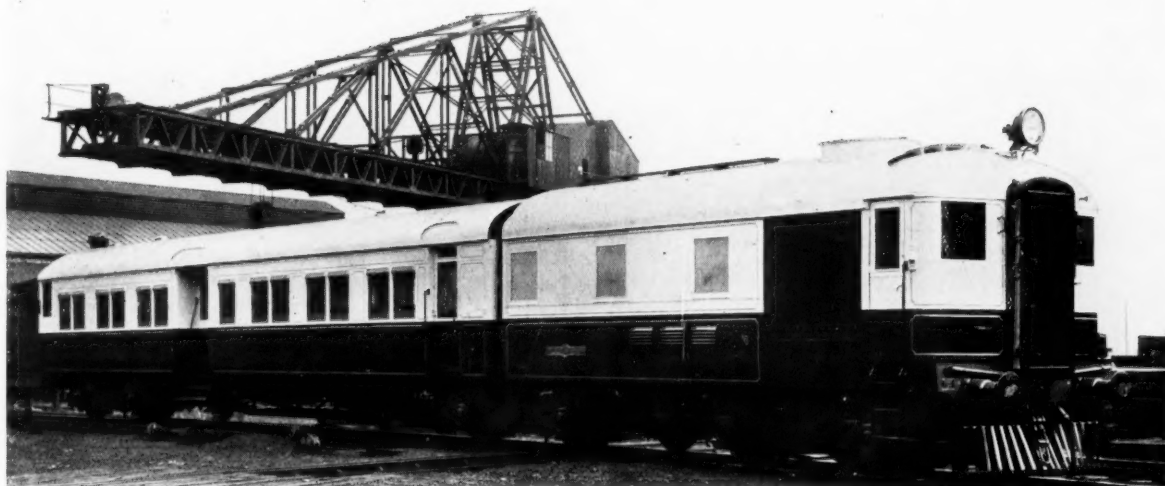
A Thornycroft sheep-carrying lorry and trailer in Central Argentine Railway service



Above and left: Wickham motor gang trolleys in use for track maintenance on the Buenos Ayres Western Railway. Note the ease with which the units can be transferred from one track to another



The limited accommodation required for garaging is shown in this view of a trolley outside its shed



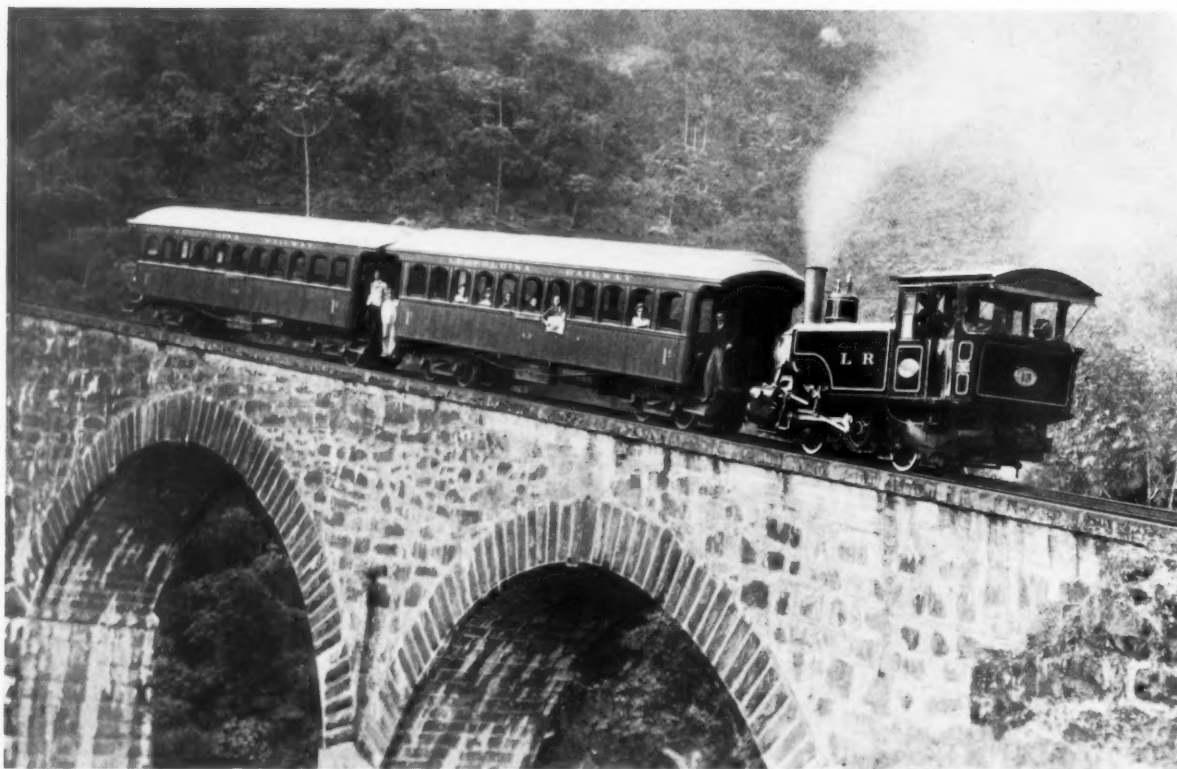
450 h.p. Armstrong-Whitworth diesel-electric articulated unit of the Buenos Ayres Western Railway



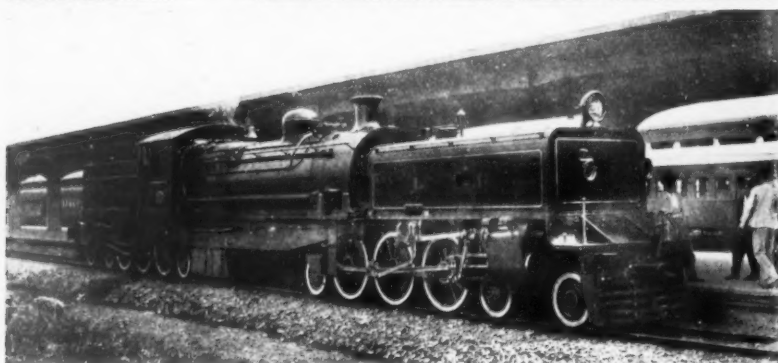
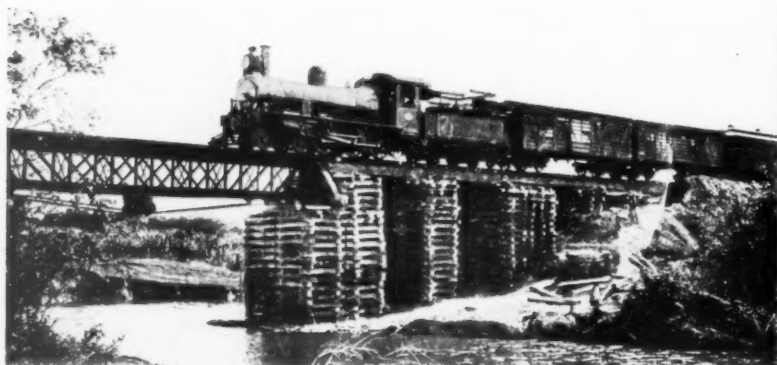
Left, front view of Buenos Ayres Western Railway Gardner-engined diesel-electric railbus built by the Birmingham Railway Carriage & Wagon Company; and, right, interior view of the same vehicle. (See article on page 14)



Thornycroft lorries in the service of the San Paulo Railway in the company's garage



Full load trial on the Petropolis rack section, Leopoldina Railway, of a rack locomotive constructed in the company's shops at Alto da Serra



Typical scenes on the Leopoldina Railway. Left, above, up-country scene; left, below, Beyer-Garratt locomotive at Barão de Maná station, Rio; right, Beyer-Garratt locomotive hauling train of coffee on the Itapemirim-Victoria section

Right : Taltal Railway mixed train from the Guanaco mines at Catalina station



Left : Loading nitrate at the Nitrate Company's sidings for transport to Taltal



Mineral train on the Taltal Railway near km. 14-200 conveying nitrate in bulk



Damaged pier and contorted girders of the Inchcape bridge, Bengal & North Western Railway, following the earthquake in January last



Earthquake effects in the Darbangha area. Left: Track sections buckled and separated by 4 to 12 ft. on the Bengal & North Western Railway. Right: Fissure in the earth beside a new extension



Bridge No. 59, two 20-ft. girders, in the Darbangha area, Bengal & North Western Railway, the pier of which has been heaved up to a height of 5 ft. 9 in. above the abutments and formation



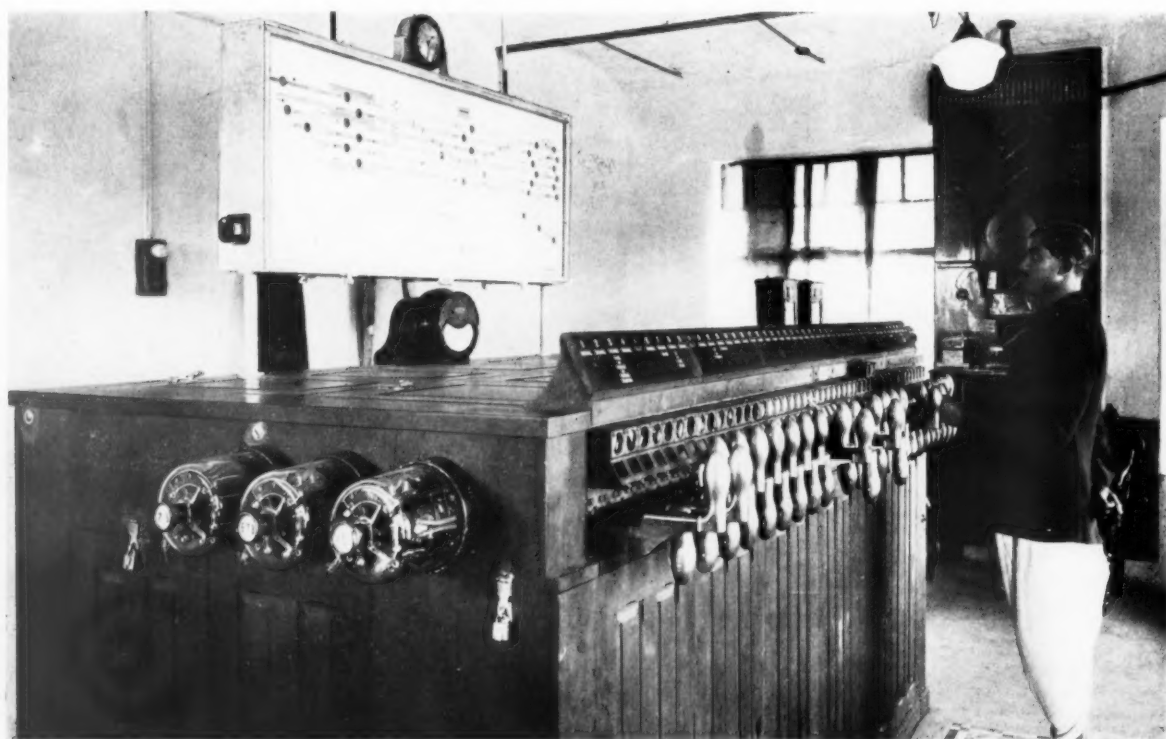
Bridge over the river Karnafuli at Chittagong, Assam Bengal Railway



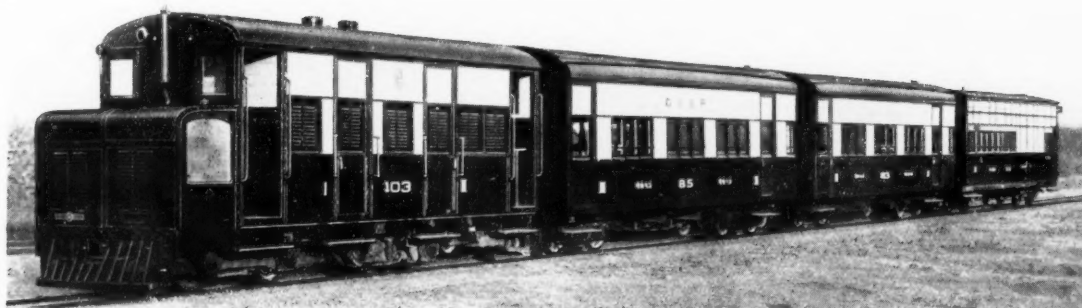
The Karachi mail leaving Lahore, North Western Railway of India, hauled by four-cylinder simple Pacific locomotive with R.C. poppet valve gear



Westinghouse Brake and Saxby Signal Co. Ltd., power-operated signalling and points at Temperley Junction, Buenos Ayres Great Southern Railway



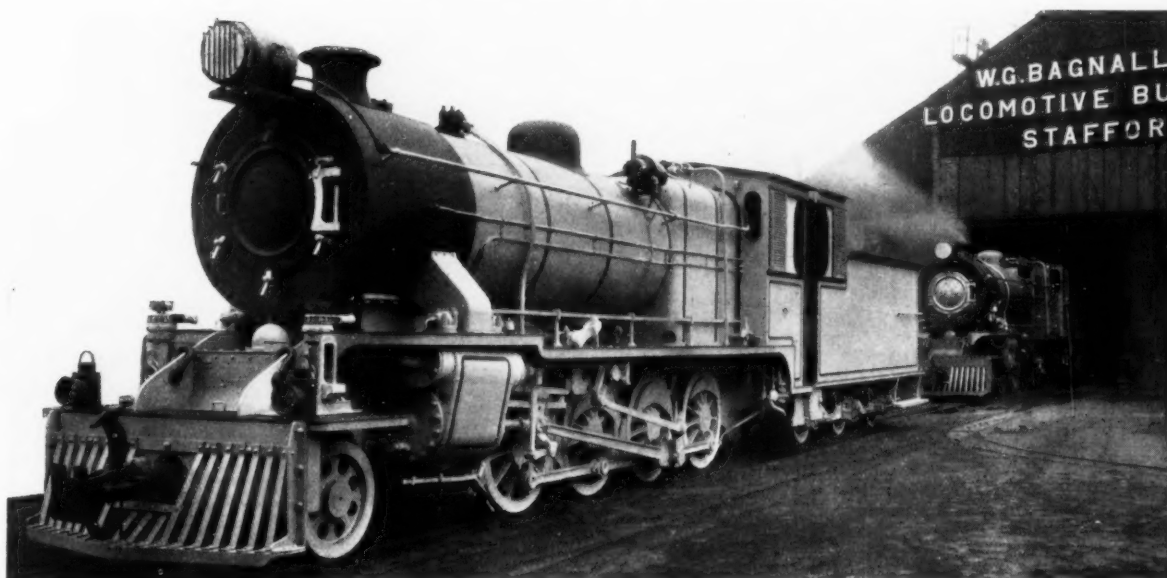
Interior of South signal box at Dum Dum junction, near Calcutta, Eastern Bengal Railway, where all-electric power signalling was installed by the General Railway Signal Co. Ltd.



A 95 b.h.p. Armstrong-Whitworth diesel-electric railcar and train on the Caekwar of Baroda's State Railway



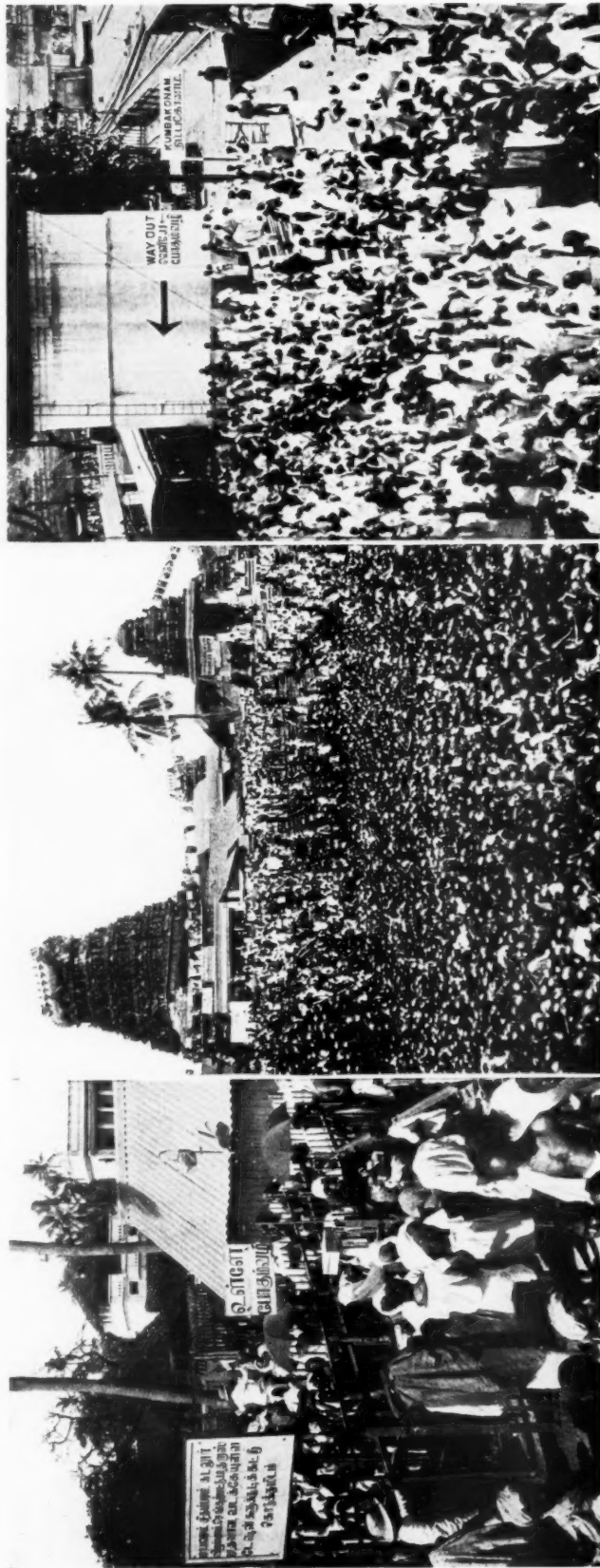
An Albion 3-ton lorry recently put into service by the East Indian Railway



One of three metre-gauge 2-8-0 freight locomotives completed early this year by W. G. Bagnall Limited, Stafford, for the heavily-graded Udaipur-Chitogarh Railway, India



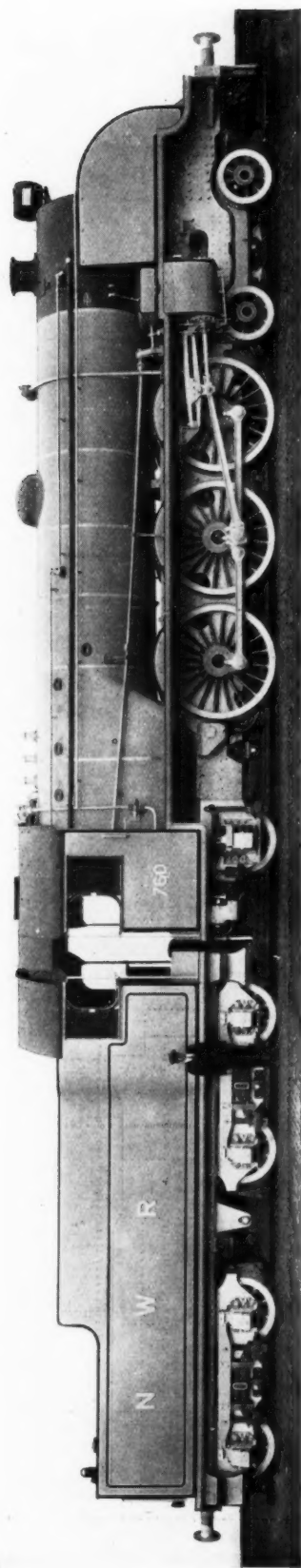
General view of arrangements made at Kumbakonam station, South Indian Railway, for dealing with 330,000 pilgrims who attended the great Mahamagam twelve-yearly festival



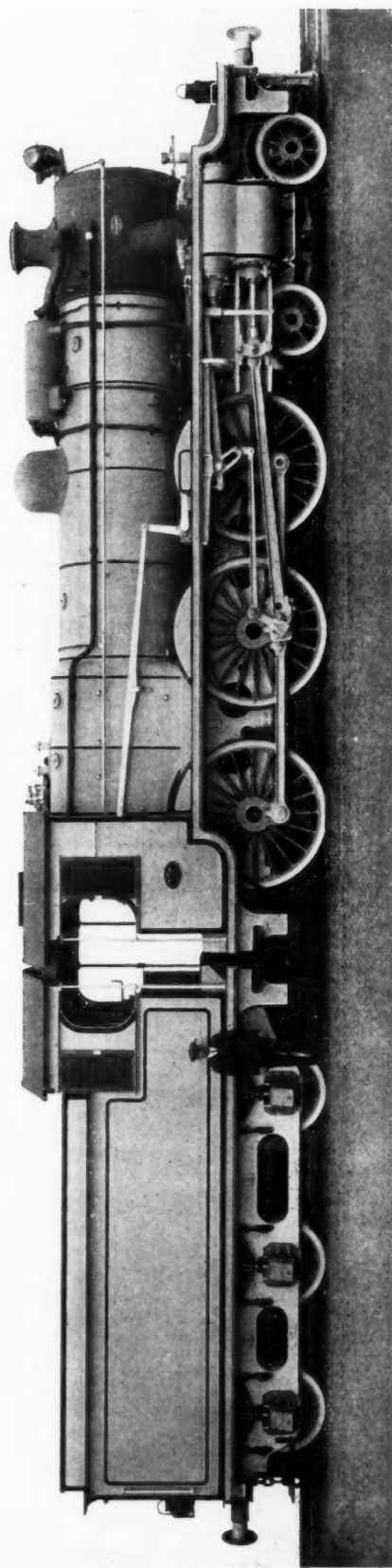
Enclosure outside temporary booking office, Kumbakonam station

Crowds assembled for bathing in the sacred Mahamagam tank

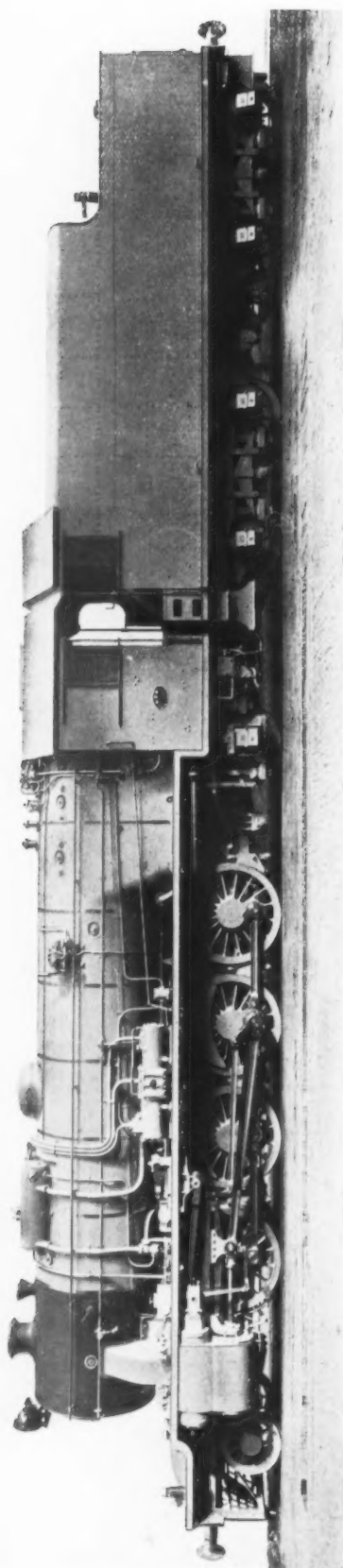
Crowd of down-arriving pilgrims on island platform, and direction board in three languages



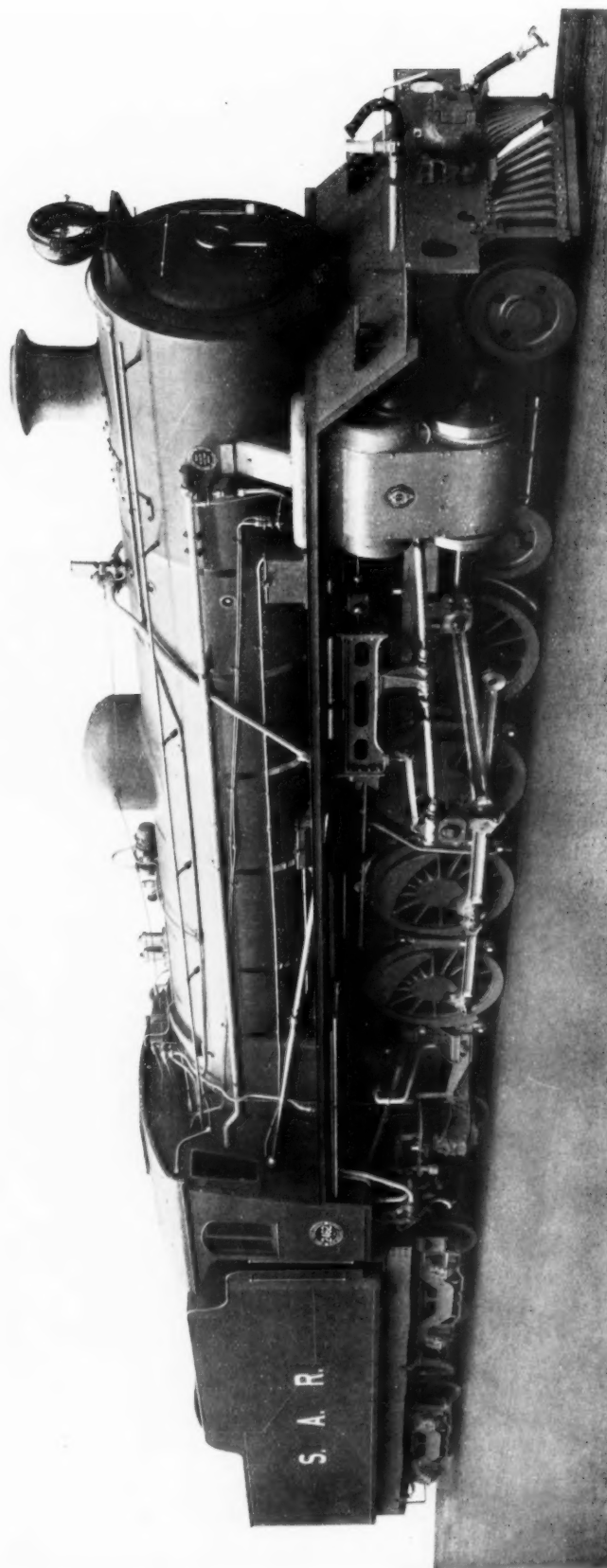
Indian State Railways standard XS type 4-6-2 four-cylinder locomotive, North Western Railway



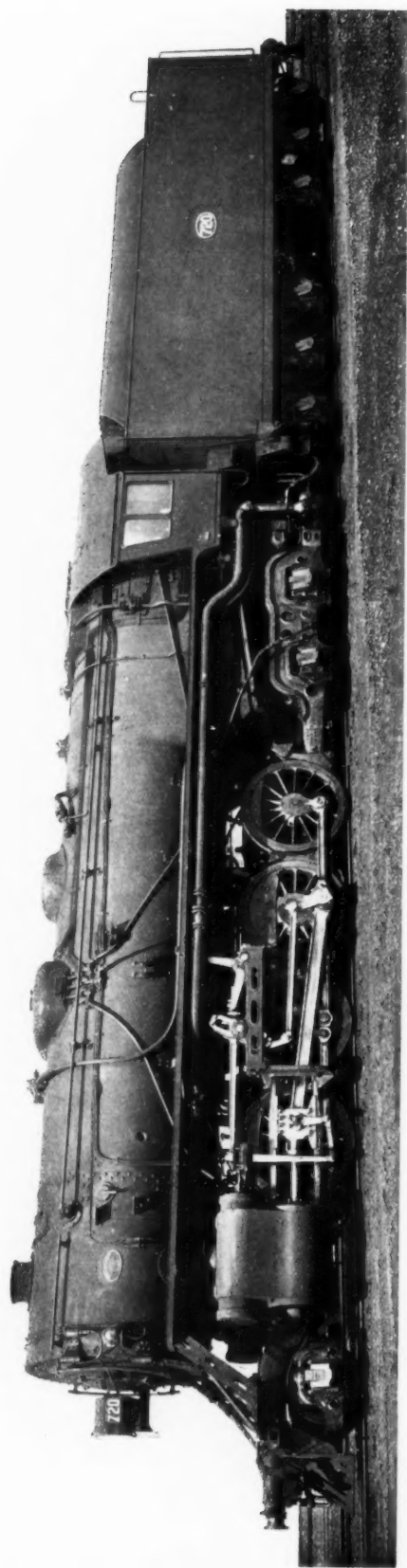
A 4-6-0 passenger locomotive recently constructed by the Vulcan Foundry Limited for express service on H.E.H., the Nizam's State Railway



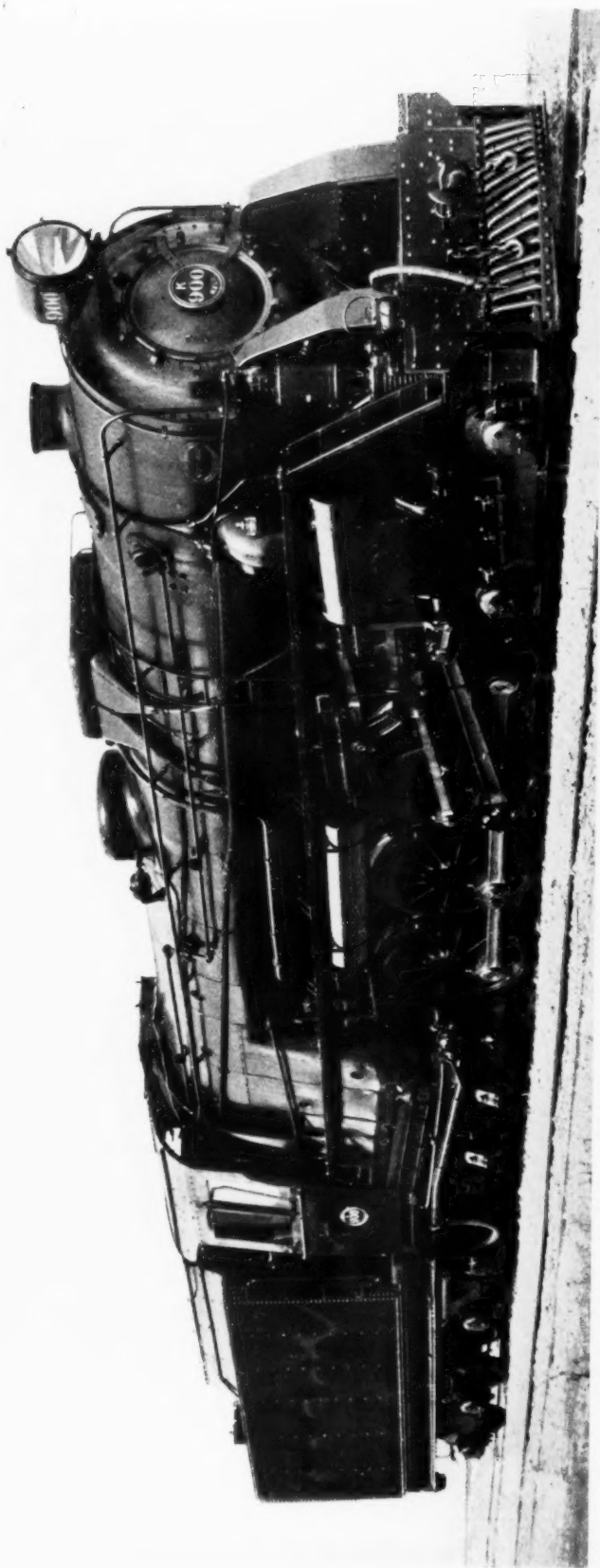
One of seven 2-8-2 locomotives built by the North British Locomotive Co. Ltd. in 1933 for H.E.H. the Nizam's State Railway. The engine shown has mechanical stoker, booster, and feed-water heater and pump



One of the fifty class 19 C 4-8-2 locomotives now being supplied to the South African Railways by the North British Locomotive Co. Ltd.



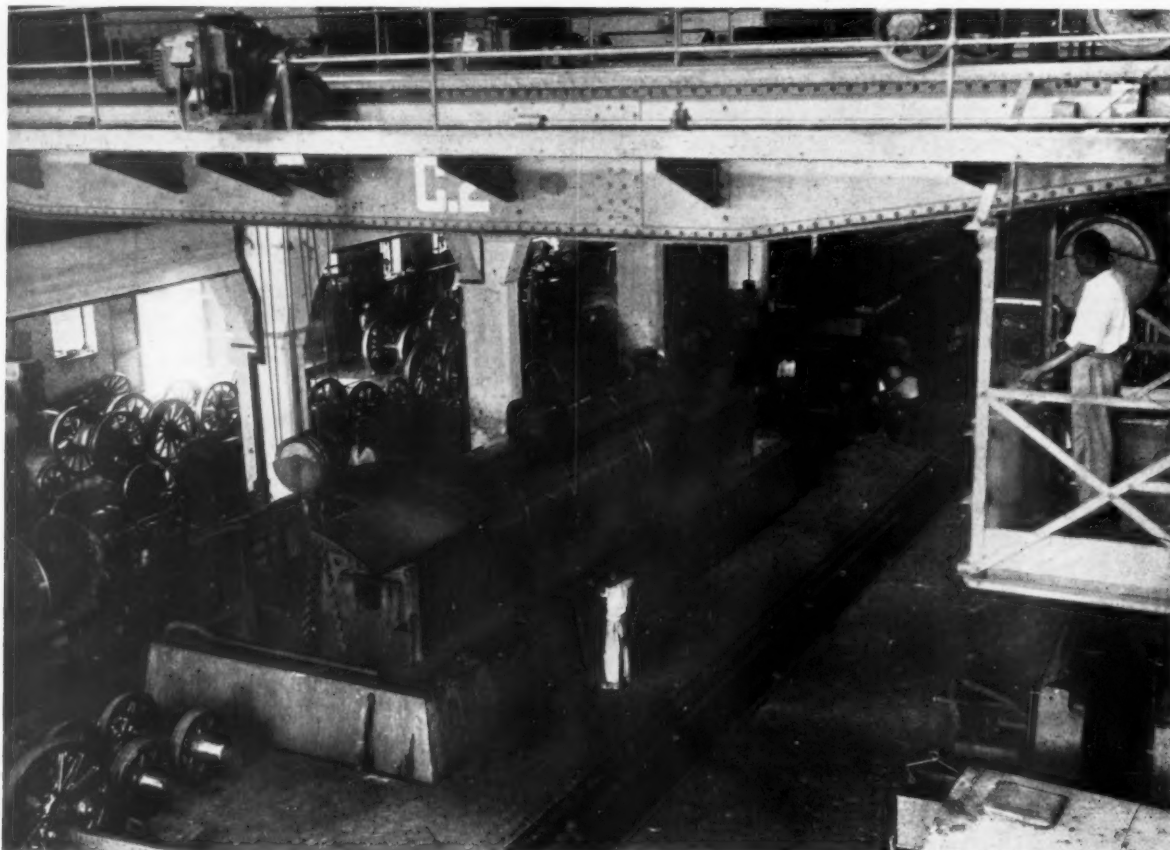
A 2-8-4 booster-fitted heavy freight locomotive, South Australian Railways, used for hauling trains between Adelaide and Mount Lofy, over long gradients of 1 in 45



New standard K class 4-8-4 locomotive with roller-bearing leading bogie, New Zealand Government Railways, designed for heavy passenger service



Axlebox section of locomotive repair shop, Federated Malay States Railways. A roller runway adjacent to the marking-off table on the extreme right conveys the boxes from bench to bench (see article on page 57)



Locomotive immersed in boshing tank at the above shops for cleaning of running gear by caustic soda solution



Mechanical accounting at Kuala Lumpur, Federated Malay States Railways, showing machines at work



Electrically-worked coaling plant at the new locomotive depot, Kuala Lumpur



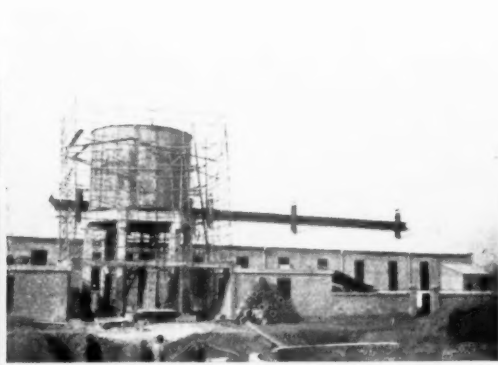
Electrically-operated 60-ft. turntable and engine round house at the Kuala Lumpur depot



Typical bridges on the final 230-mile link of the Canton-Hankow Railway between Lukow and Shaochow, now under construction



The 8.15 a.m. Hong Kong-Canton express leaving Kowloon station, Hong Kong. It is an eleven-coach train weighing about 450 tons and the locomotive is a British built 4-6-0



Boxer Indemnity Fund materials to be used in completing the Canton-Hankow Railway. Left: 43-kg. rails being landed at Whangsha wharf. Right: Lochang station water tank, built of B.I.F. materials



Thornycroft lorry negotiating difficult country in Natal, in the service of the South African Railways



The Union Limited leaving Johannesburg new station headed by class 16 DA locomotive No. 877. The elevated luggage way can be seen in the left background, and the administrative offices of the South African Railways in the centre background



Self-propelling floating crane at Durban Harbour, South African Railways. The crane is undergoing test with a 35-ton load



Twinning of Shongweni tunnel, Natal, during the Cato Ridge-Clairwood doubling, South African Railways



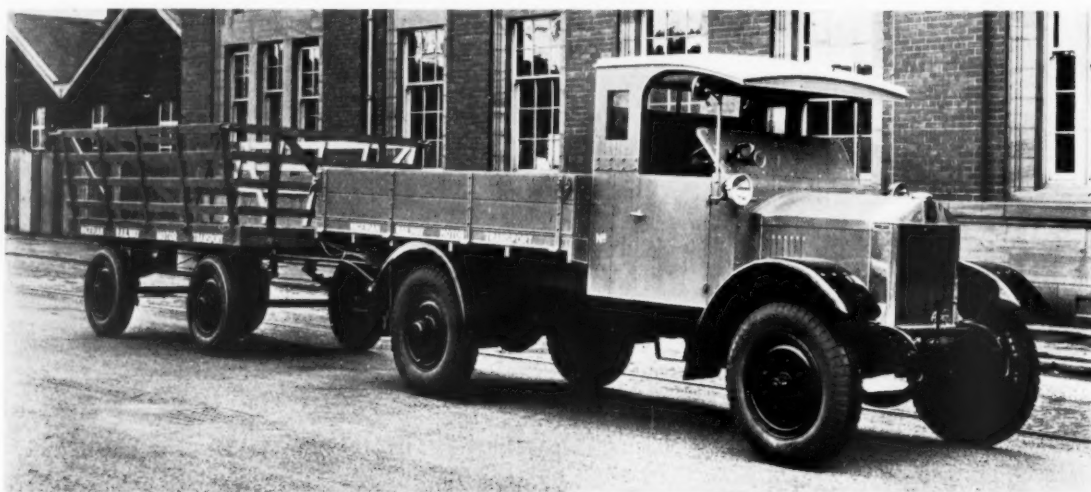
Six-car electric train in Monument station, Cape Town, South African Railways



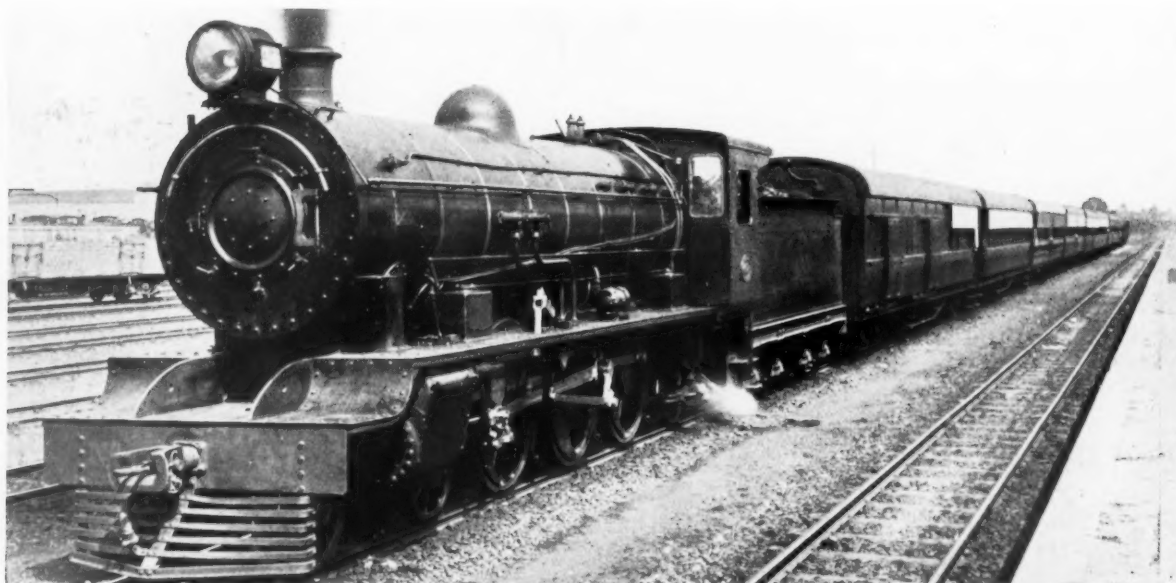
The 33,000-kW power station at Colenso for the South African Railways electrification scheme



Beyer-Garratt locomotive of 40,000 lb. tractive effort in service on the 3-ft. 6-in. gauge Nigerian Railway, hauling a goods train of 850 tons on track laid with 45-lb. rails. This is the largest steam engine in the world working over so light a rail



One of the 24-h.p. 2-ton Albion lorries, with four-wheeled trailers, which are doing good service with the Nigerian Railway



Western Limited express, Nigerian Government Railway, hauled by a 4-6-2 locomotive of 21,500 lb. tractive effort



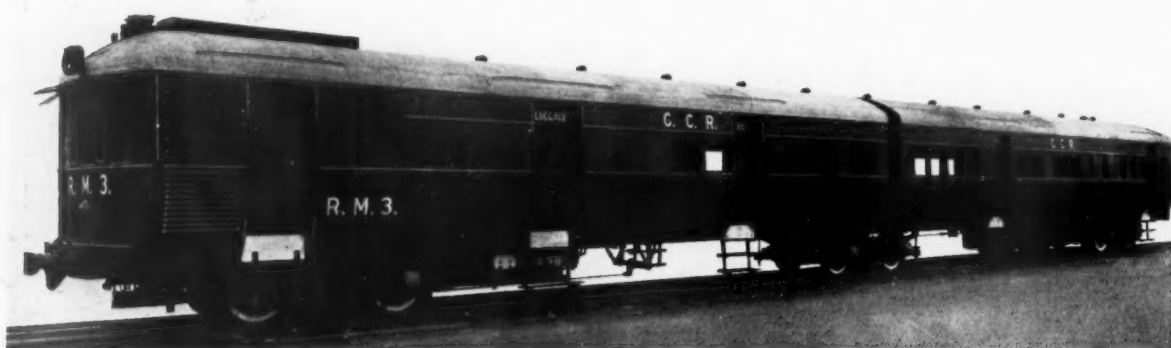
Locomotive running shed at Nairobi, Kenya & Uganda Railways



Beyer-Garratt locomotive crossing viaduct near Kijabe, hauling mail train between Nairobi and Nakuru, Kenya & Uganda Railways



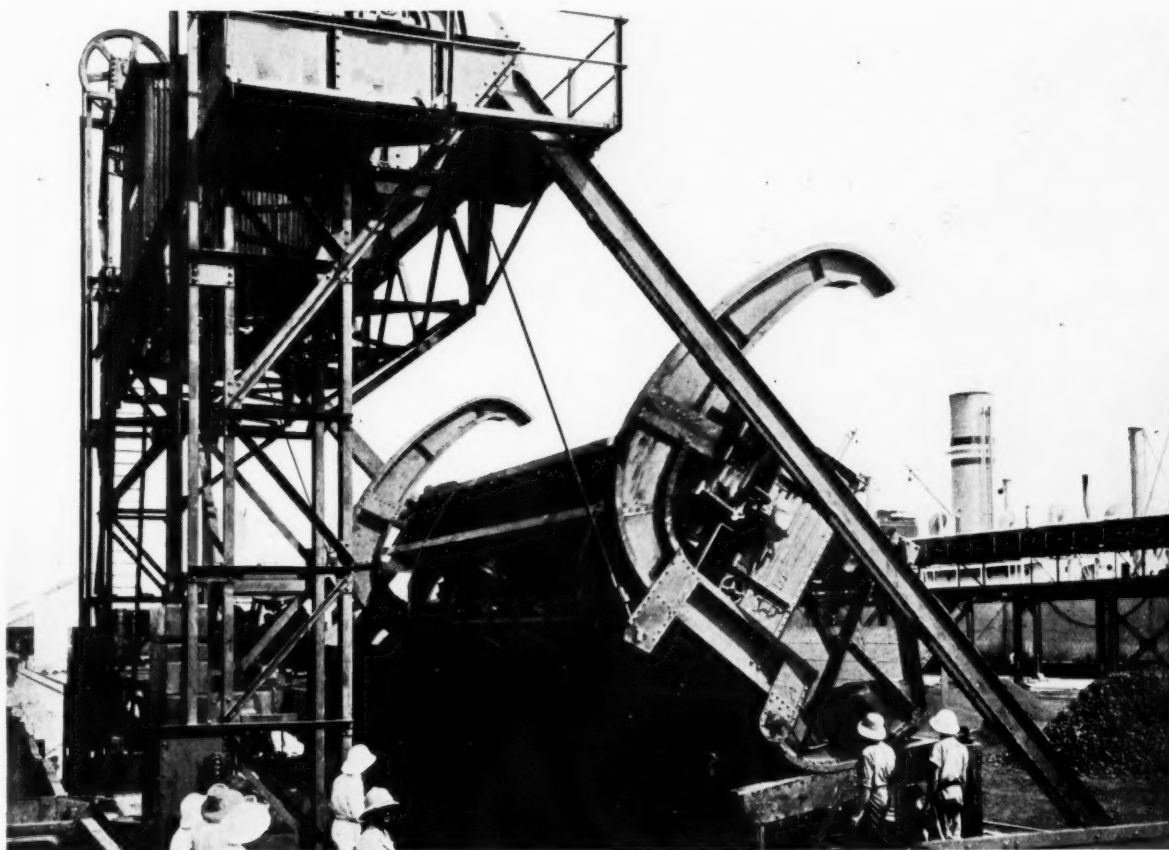
Manganese ore train en route to Takoradi harbour, Gold Coast Railway



Sentinel articulated steam railcar running on local services in the Kumasi (Ashanti) district of the Gold Coast Government Railway (see article on page 62)



Railway and Harbour Administration building at Takoradi, Gold Coast Railway



Electrically-operated 25-ton wagon tippler discharging manganese ore on to belt conveyor for shipment at Takoradi Harbour, Gold Coast Railway



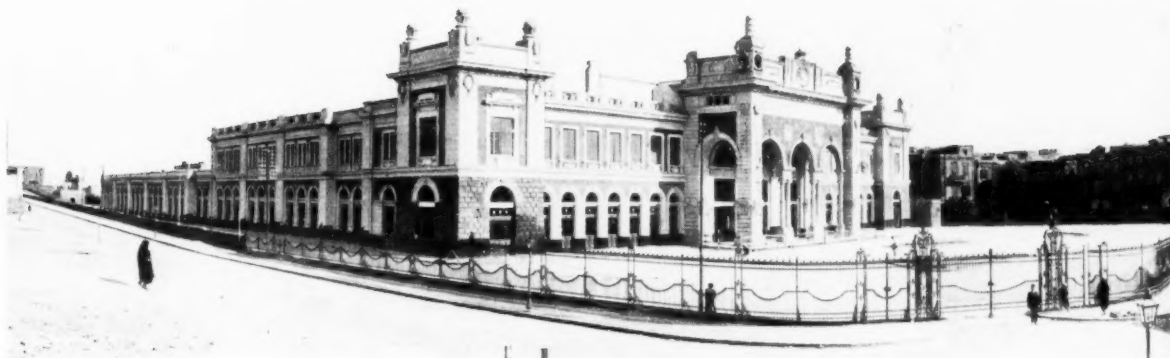
Edfina bridge over the Nile, Egyptian State Railways, Rosetta branch



New Giza station building under construction, Egyptian State Railways



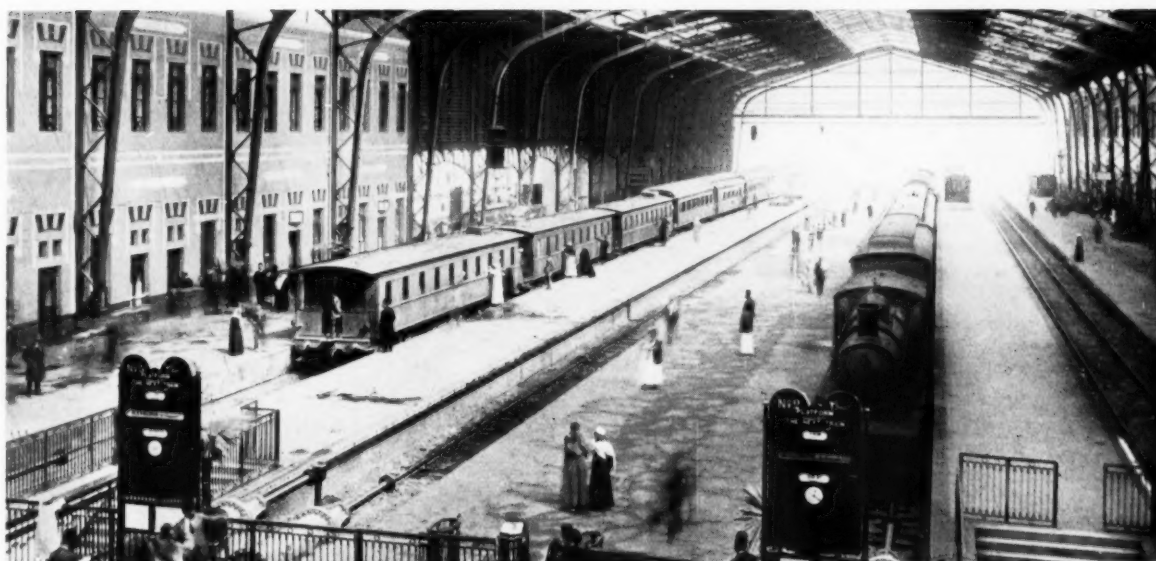
Market train leaving Damanhour, Egyptian Delta Light Railways, hauled by a Sentinel locomotive



New station at Alexandria, Egyptian State Railways



One of the first containers in Egypt being towed by a Fordson tractor. They are constructed of plywood on a timber frame, and the dimensions are : length 12 ft. 6 in., width 7 ft. 4 in., height 8 ft. 3 in., and were built by the Egyptian State Railways



Interior of Cairo main station, Egyptian State Railways



Victorian Government Railways C class 2-8-0 locomotive constructed in the workshops of the administration at Newport. The smokebox is of the self-cleaning type



All-welded 27-ton class IZ wagon of the Victorian Government Railways. The tare weight is 9 tons 10 cwt.



Welded rails on the Victorian Railways showing, on the left of the picture, 100-lb. rails in track before welding, and, right, 100-lb. rails re-used and welded into 225-ft. lengths by the Thermit process



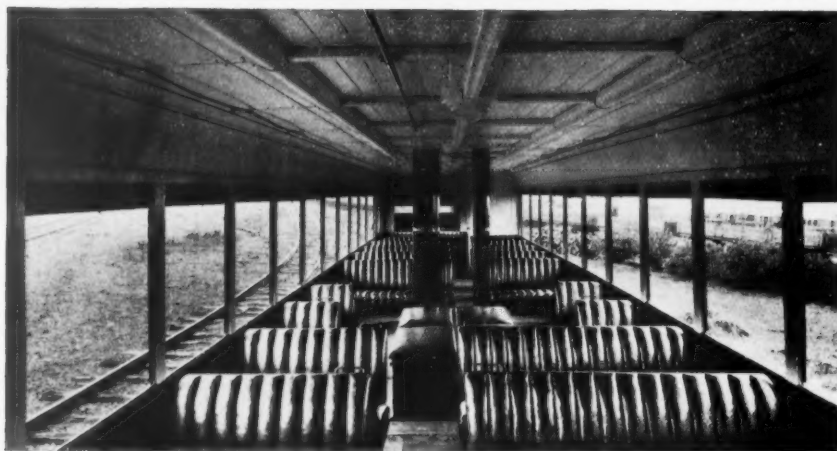
Left: New Zealand Government Railways train negotiating the original 1 in 40 gradient out of Wellington. Right: The Tawa Flat deviation under construction



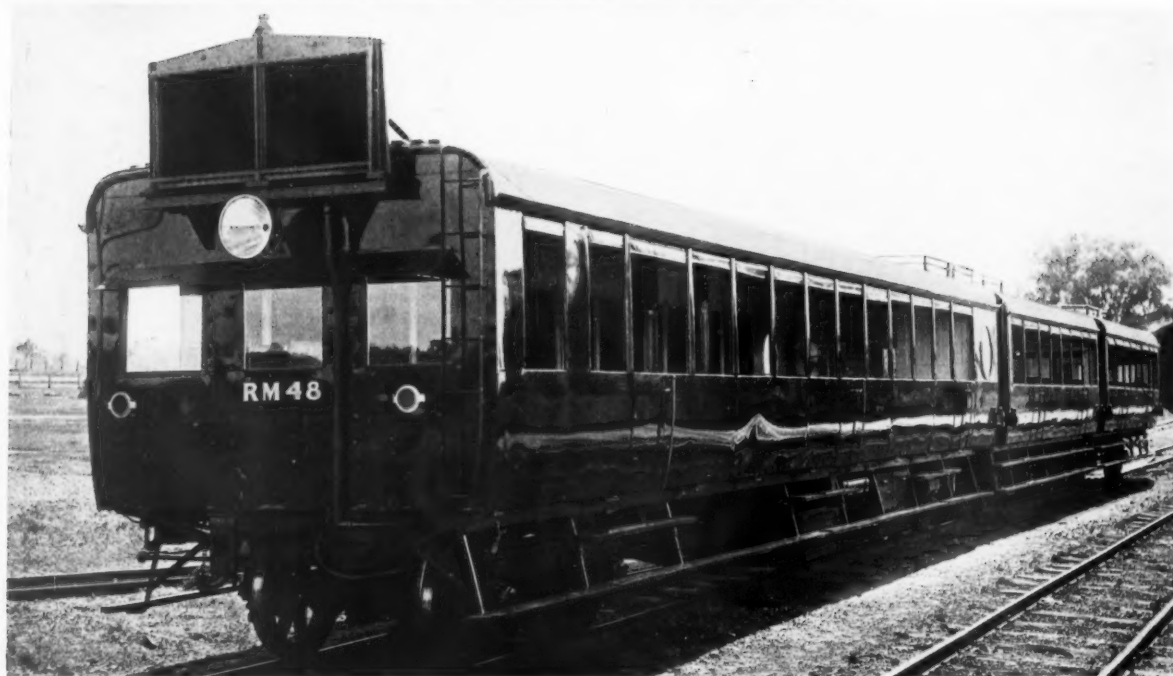
New Zealand Government Railways mixed train working through impressive scenery in the forests of Central North Island



Above: 100-h.p. corridor type rail motor and trailers for local services on Queensland Government Railways



Left: Interior view, looking to rear, of 100-h.p. and 150-h.p. open type cars



Below: 150-h.p. car with trailers, Queensland Government Railways



The Dominion Express of the Canadian Pacific Railway passing Terminal Dock, Vancouver, British Columbia



Canadian National Railways : A view of the approach to Union station, Toronto, Ontario. The Canadian National Railways position is outlined in an article on page 71



Above: Train leaving Haifa station, Palestine Railways, for El Kantara on the Suez Canal



Right: Rafa (Sinai Desert) new station building. This station is at the boundary of Egypt and Palestine



Left: Part of the track relayed with steel sleepers on the Jaffa-Jerusalem line, Palestine Railways

THE LEOPOLDINA RAILWAY

The adverse coffee situation in Brazil has added to the problems of this company, already embarrassed by road competition in passenger and freight traffic and difficulties of exchange

THE problems with which this railway is concerned may be considered under two headings, according as they are occasioned by special circumstances or inherent in the operation of the line. In the former category, competition from rival means of transport—i.e., that of other railways, such as the Central of Brazil and the Victoria-Minas, and also that of road and water services—exercises its influence over an extensive zone. Roads in particular constitute a severe menace, and since the Brazilian Government intends to push ahead its policy of highway construction, the resultant encroachment upon the railway's domain will render the problem of traffic retention still more acute.

Very closely linked up with competition is the rate question, and the heavy loss sustained through the ability of the road and water hauliers to quote arbitrary figures for the conveyance of highly-rated commodities (the remunerative carriage of which by rail offsets the small returns accruing from the low-rated articles), combined with the Government's repeated refusals to sanction increases in the cheaper rates with a view to minimising this loss, produces one of the biggest obstacles to the operation of the railway on a paying basis.

Even the passenger side of transportation has become a problem of increasing severity, especially when it is realised that for an average distance of $7\frac{1}{4}$ miles the average fare on the suburban trains is equivalent to 0.84d., and that, numerically speaking, suburban traffic represents approximately 89 per cent. of the Leopoldina's passenger carryings.

Effects of the Crisis

When the economic and financial crisis struck the world at the latter end of 1929, a disaster of a far-reaching nature took place in Brazil, in the devaluation of the Leopoldina's principal source of revenue—coffee—and the relatively low price at which this commodity has remained ever since has a doubly depressing effect, in that the *ad valorem* component of the freight suffered a *pro rata* reduction with the fall in price, while, more serious still, the shortage of money in the interior in consequence of the adverse coffee situation involves fewer purchases of general merchandise and, therefore, heavy decreases in rail-shipments.

With the country's finances seriously perturbed by the long-continued crisis, resulting in blocked funds and the unfavourable conversion rate from milreis into sterling, even when they are eventually released, and with the virtual impossibility of further reducing overhead charges now made a complete impossibility, in consequence of the additional onus of increased wages imposed by a Government Labour Commission, the problem with which the Leopoldina is now faced, of paying its way and producing a return on its capital, is worse than any that have arisen in the course of the railway's existence.

As regards problems inherent in the operation of the railway, these may be summarised briefly:—

(1) The necessity for having three different types of rolling stock—plane line vehicles for ordinary purposes and rack and scissors-brake stock for the Petropolis and Friburgo mountain sections respectively, the preponder-

ance of the first mentioned giving rise frequently to routing and distribution difficulties.

(2) With the exception of, roughly, 500 kilometres of line serving the low-lying littoral regions, the whole system is replete with heavy and lengthy gradients (often exceeding 3 per cent.) and sharply curved stretches, with six well-separated summits ranging from 715 to 1,075 metres above sea-level, and this makes the problem of working the bulk of the goods traffic expeditiously (and at the same time economically) a matter of difficulty, owing to the frequent changes in engine loads, whereby wagons have to be staged *en route*. This difficulty is increased by the embargo on the working of goods trains *at night* (except on the flatter sections), on account of the nature of the line combined with the absence of fencing in many areas.

(3) Really heavy traffic is limited to *one* season in the year (approximately from June to November), when the coffee and sugar-cane crops are being gathered. Not only does this make extremely heavy demands upon rolling stock (which, during the remaining portion of the year, is more than sufficient for the needs of traffic), but the fact that the movement is largely *one-directional* occasions the unremunerative working of empty stock—at times in whole train-loads—back to the loading areas.

(4) Owing to the declivitous nature of the country traversed by a great portion of the Leopoldina's system, landslides occur with some frequency in the rainy season, some of them being serious enough to cause interruptions in traffic for weeks on end; floods and washaways in the low-lying areas are responsible for similar inconveniences.

(5) One of the economy measures introduced in recent years was the substitution of coal by wood-fuel, with the result that, at the present time, the burning of the former is virtually limited to the tank engines working the suburban trains and to the Petropolis and Friburgo "serra" locomotives, and also to one or two areas where either suitable firewood is unobtainable or the engines employed render the use of coal imperative. Considerable work is involved in the loading and distribution of firewood to numerous deposits and replenishing-points along the line, special trains and staff having to be allocated for this purpose; moreover, in view of the extra time occupied in re-fuelling and the greater frequency with which this has to be done, it has been necessary to "ease" the schedules of various trains.

Operating Developments

Turning to important and interesting developments in relation to the working and progress of the railway, one may mention, first of all, the fitting of 150-200 goods vehicles with automatic vacuum brake in the course of the last 12 months. At present, a number of these vehicles are being concentrated on the Itapemirim-Victoria stretch, over which a heavy coffee traffic is operated at the height of the season, and where, hitherto, the severe gradients combined with limitation of axle load on the track, have necessitated the working of numerous lightly loaded trains daily. With the vacuum fitted stock, however, and the use of Garratt engines, fewer trains are being run,

greater safety secured, and considerable economy effected by the elimination of brakemen.

The urgent necessity for reducing the total extent of earth ballasted track which is not only provocative of discomfort to passengers, but also places a restriction on speed with safety, has induced the company to push ahead with its stone ballasting programme, and such progress has been made, that 110 kilometres of the main litoral line between Visconde de Itaborahy and Macahé are now macadamised; the entire programme (which forms part and parcel of the "improvements" works authorised by the State Government—to be alluded to later) embodies the stone ballasting of the line between Rosario and Visconde de Itaborahy, Nictheroy and Cachoeiras, and Visconde de Itaborahy and Campos, a total of 355 kilometres.

Although not strictly coming within the range of developments during the last 12 months, mention should be made of the inauguration, in May, 1933, of the Portland Cement Company's Factory at Guaxindiba, situated on the Leopoldina's line 21 kilometres from Nictheroy. This has given rise to a new and useful albeit low rated traffic for the railway, averaging 10,000 tons of cement a month between Guaxindiba and Praia Formosa goods station—a distance of 88 km.

Traffic Control and Organisation

The use of selective train-control telephones, which in 1926 were employed on 314 km. of line, has been considerably increased since that date. Additional stations were placed under the jurisdiction of the existing Barão de Mauá and Campos control offices, while new control offices at Rio Bonito and Itapemirim, with 148 and 254 km. of line, respectively, under their supervision, were installed, with the result that the total controlled area now amounts to 843 km. There is no need to stress the advantages possessed by this system, in enabling, at the height of the busy season, a heavy freight-train movement to be handled over long stretches of single line with expedition, as well as wagon distribution and the circulation of sugar-cane specials to be organised.

Approximately three years ago, a modified form of decentralisation of executive work was adopted, by the inauguration of a Divisional Traffic Office with headquarters at Campos. This Office is in reality a combination of two of the original Traffic Inspection Offices, plus a portion of a third, and is in charge of a Head Office Representative, who has limited jurisdiction over more than 800 km. of line with regard to train movement and wagon distribution, staff and claims matters, and stores.

With the object of improving the traffic working in the environs of the terminus in Rio, a third and fourth track between Barão de Mauá and Belfica Junction—5½ km.—were brought into use in 1931, being utilised for the circulation of express and special passenger trains and also all freight trains. A new signal cabin, with 180 levers, 7 of which are spare, was inaugurated at about the same period in Barão de Mauá terminal station for the controlling of the busy movement in the station and yard.

Suburban traffic between Barão de Mauá and Penha (11.9 km.) and Caxias (19.2 km.) has grown enormously of recent years, and the serious overcrowding of trains during the morning and evening rush-hour periods has for long been demanding an increase in the daily train-service. A 34 per cent. increase is already considered a necessity, but, as this will involve the acquisition of additional locomotives and rolling stock, thereby increasing the working costs, which the relatively small passenger increment could not, on the basis of the ridiculously low fares at present in force, possibly defray, a state of *impasse* exists until the Government sees fit to

authorise an increase in suburban fares. Ultimately to permit of an intensive suburban service being worked efficiently, it will be necessary to extend the quadruplication of the line from Belfica Junction to Penha (if not to Caxias), which would in turn oblige a comprehensive scheme, consisting of aforesaid quadruplications, installation of automatic signals and the use of Webb & Thompson miniature staff instruments for the operation of the remaining 15 km. of single line to Raiz de Serra, being put in hand as soon as finances warrant it.

In recent years a certain number of improvements have already been authorised under the heading of the "10 per cent. Improvements Fund." These funds, of which there are three in number, under the auspices of the Federal Government and the Governments of the States of Rio de Janeiro and Minas Geraes, were inaugurated approximately seven years ago, being formed of the product of a 10 per cent. surcharge on all rates pertaining to traffic carried in the respective concession areas. This product has to be devoted to improvements and new works definitely sanctioned by the respective Governments, although the company is at liberty to submit its own syllabus for approval. The works actually sanctioned for the immediate future include the completion of the stone-ballasting (already alluded to), the building of new stations—more particularly those at Petropolis (the foundation stone of which was laid on February 19, 1933), Friburgo (already being tackled), Carangola and Miracema—and the acquisition of railcars (exact type not specified so far), the latter, especially, being urgently needed for the efficient combating of road competition on branch lines, where the infrequent train service is not only costly but unremunerative.

The company has included in its syllabus of requirements for the ensuing four years sundry additions to its locomotive, carriage and wagon stock (including the purchase of more Garratt engines), as well as the lengthening of sidings and modification of the layout at stations for the more efficient handling of traffic, but each item has to remain pending subject to Government sanction.

The extent to which these 10 per cent. Funds have been utilised since their inception in the acquisition of new rolling stock, building and modification of stations, permanent way alterations, construction of fences, &c., may be gathered from the fact that the total expenditure up to the end of April, 1934, under this heading amounted to 35,086 contos (approximately £582,500 at the official rate of exchange), distributed as follows: Minas Geraes, 10,010 contos; Rio de Janeiro, 13,123 contos; Federal Government, 11,953 contos.

The company has in operation 1,918 route miles of line on the metre gauge, a length which has not increased since 1931. The railways are held under separate concessions for different sections respectively from the Federal Government of Brazil, and from the States of Rio de Janeiro and Minas Geraes. Gross receipts in sterling for the year ended December 31, 1933, amounted to £1,277,694, a decrease of £301,157 or 19.07 per cent. In currency, gross receipts showed a decrease of 10.51 per cent. Working expenses, in sterling, amounted to £1,047,205, a decrease of £51,849 or 19.07 per cent., but expenses in currency advanced by 4.13 per cent., and net receipts in sterling (£230,489) were lower by £249,308. Including the £177,804 brought forward from the previous year and other credits there was a sum of £410,044 at the credit of net revenue account, which was sufficient to cover interest and other prior charges, leaving £40,691 to be carried forward. There has been no distribution on the £2,845,340 of 5½ per cent. cumulative preference stock since June, 1930, when a dividend was also paid on the £6,870,690 of ordinary stock.

THE TALTAL RAILWAY

This company has taken a new step in transport enterprise by the conveyance of nitrate in bulk at favourable rates

FOR the first time in the history of the railway, nitrate has been transported in bulk. Previously it was conveyed in sacks containing 100 kg., the net down wagon load averaging 19·4 tons. Net wagon loads of bulk nitrate commenced at a little under 15·0 tons, but after several tests an arrangement was arrived at with the nitrate producers for a standardised load, due to which the railway now counts on an average of 19·0 tons, almost equal to that of sacked nitrate and without any expense having been incurred in modifying the rolling stock, except the replacing of doors on 300 wagons. The handling over railway moles into lighters, however, necessitated the erection of two double chutes on Mole No. 2, one on each side, as the single chutes in service were not long enough to accommodate wagons of bulk nitrate with both doors down. These double chutes are also used for gravity loading mineral ore into lighter, the tonnage of which was 15,893 tons for year ending June 30, 1934, as compared with only 2,112 tons in the previous period.

The capacity of each double chute per legal working day, under normal conditions, is 600 tons bulk nitrate, or 500 tons mineral ores. These quantities can be increased by utilising gantry cranes and large iron buckets used in discharging coal from lighters, therefore it is possible to ship 2,000 tons of bulk nitrate per diem, also in addition 1,400 tons of sacked nitrate down the single chutes on Mole No. 1. Moles Nos. 3 and 4 are at present out of service awaiting increased shipments of nitrate.

The transport and shipment of bulk nitrate is now common at all nitrate ports, i.e., Taltal, Antofagasta, Tocopilla and Iquique. It is also the present practice in the nitrate industry to ship direct, thus avoiding double handling charges in port for off-loading into warehouse and re-loading on to car. In consideration for a fixed payment as part compensation for loss of terminal charges, most of the nitrate warehouses have been converted into covered car storage sheds with a total capacity of 258 wagons, that is to say approximately 5,000 tons of nitrate can be stored on car under cover awaiting steamer arrivals. This system allows of more regular down train movement and consequently a reduced permanent train staff.

All the Taltal Railway rolling stock is fitted with centre buffer and the pin and link for coupling. Engines on the main line coast down to Port and the trains are hand braked by the train staff, three vehicles to each brakeman. Engine brakes are only used in cases of extreme emergency. On the two principal branches there are counter grades to be negotiated, the heaviest that on the Santa Luisa Branch necessitating the down convoys of 20 wagons being halved over a length of 8 kilometres. The tare weight of the 594 wagons used for the transport of nitrate is 6·7 tons and the net, as previously mentioned, is 19·4 tons sacked and 19·0 tons bulk. Without doors the tare weight was 6·13 tons, but all of these have been replaced.

The transport charge for nitrate in the 125 kilometre zone is \$18·50 gold per ton, nominally 9s. 3d., payment however, due to the control of exchange, is made at Central Bank rate, at present about 49 to the pound sterling, whereas the exportation draft rate is 130 to the pound, and it is only by this latter quotation that one can get money out of Chile, which therefore serves as the basis for the sale of all imported materials and in a lesser degree national articles as well. Railway freight includes placing into lighter over railway moles, but excludes loading of cars at oficina, which is done by the Nitrate Company's own workmen. An extra charge is made as compensation for loss of terminal receipts and is levied on the tonnage of nitrate actually shipped. In reality it is to recompense the holding up of wagons and consequent additional shunting operations involved in sorting out. All nitrate oficinas in the Taltal Pampa are situated within the 125 kilometre zone.

The transport of mineral ores in large quantities for export is a new traffic and originates at the Guanaco Mines about 130 kilometres from the seaboard. It is mostly composed of low grade gold ore with a high copper and silver content, but its continuance depends to a great extent on a depreciated currency which permits of low labour and rail costs, as mineral ore freights, unlike nitrate freights, are on a currency and not a sterling basis.

CENTRAL ARGENTINE RAILWAY

The Central Argentine is the second largest British-owned railway in South America. In its present form it represents an amalgamation of several important systems at different periods throughout the past 68 years. The principal amalgamation was that with the Buenos Ayres & Rosario Railway, which was authorised by the Argentine National Government in 1908. Since that date extensions of considerable length have been carried out, of which the latest is the Villa del Rosario and Cordoba to Forres branch opened throughout in April, 1933, so that the company now has 3,700 miles of 5 ft. 6 in. gauge line in operation. It has a very dense suburban traffic in and around Buenos Aires, stimulated by the complete electrification of its railways in that area, and the improved services rendered possible by judicious widenings and the installation of automatic signalling. The growth of this traffic has, however, been to some extent checked in the

past two or three years by the prevailing commercial depression and the unregulated competition of omnibuses and collective taxis. The Central Argentine was the first railway in South America to adopt electric traction on a large scale. Its new terminal station at Retiro is a real ornament to the capital of the Republic as well as a boon to the travelling public. The system extends from Buenos Aires to Tucuman in the north and Cordoba in the west, and serves the great port of Rosario, the second city of the Republic, and the port of Santa Fe, and has to contend with intensive competition from road and water transport as well as other railways. Careful attention has been devoted of recent years to stimulating "occasional" travel by the provision of special excursion facilities, comprising Buenos Aires, Cordoba, and other important points over holiday periods. The first stage of the widening already alluded to is described in an editorial note on page 3.

BENGAL & NORTH WESTERN RAILWAY

Description of the line and traffic, of the latter, sugar cane transport has shown a notable increase; also the earthquake last January

IN giving some of the problems with which this railway has to contend, it will perhaps be useful to state briefly where it is situated and show what bearing its position has in relation to some of these problems.

The system, extending to 2112 miles, part of which is owned by the company and part by the State, is almost wholly single line metre gauge. Situated in the United Provinces and Behar, it extends from Sitapur on the west where it joins the Rohilkund & Kumaon Railway, to Katihar on the east, its junction with the Eastern Bengal Railway. On the north it extends as far as the boundary of Nepal and serves as a means of communication between that country and India. From Allahabad in the south-east, a line follows in close proximity the course of the Ganges on the north side of the river for a distance of about 400 miles.

The system traverses some of the most fertile and populous districts in India, the principal cities served by it being Lucknow, Benares, Cawnpore, Allahabad and Patna. The country is flat and intersected by numerous rivers which form tributaries of the Ganges.

The chief products are sugar cane, which has increased very much in recent years; rice, linseed, grain, wheat, timber and tobacco. These products in their raw or manufactured state comprise the chief items of freight which originate on the system and pass through to foreign lines. There being no coal fields in the northern parts of either the United Provinces or Behar, coal is the chief import, rice, salt, iron, steel and kerosene oil following next in order of tonnage. The railway being thus dependent on a supply of coal from outside, it is necessary always to hold in reserve a stock sufficient for locomotive purposes and for power used in the workshops.

In addition to its eastern and western connections with contiguous lines, which have already been mentioned, its chief transshipping centre for foreign traffic is at Mokameh Ghat on the Ganges. Here, and at several other points above and below Mokameh Ghat, the railway runs a ferry service across the River Ganges to connect with the main line of the East Indian Railway which runs between Calcutta and Delhi.

Of foreign traffic passing over the system, about 50 per cent. is transhipped at Mokameh Ghat, and as this represents a large percentage of the total traffic carried, including most of the coal consumed by the public and by the company, it will be seen how vital a transshipment centre Mokameh Ghat is to the railway and how necessary it is for this line of communication to be kept open. Due to the formation of large sandbanks and shoals, this is at times extremely difficult, necessitating the frequent shifting of the ghat lines, while the ferry steamers have to be maintained in a state of efficiency in order to avoid any congestion of traffic on either side of the river.

A matter which requires careful attention is the maintenance and protection of large bridges. The meanderings of the Ganges and her northern tributaries, over which these bridges have been constructed, are so variable that protective measures have to be taken to train and hold the rivers to their bridges so that they may not be flanked.

In certain areas precautions such as strong patrols of police have to be taken to prevent the breaching of the embankments by the villagers in times of heavy rains

when they are induced to find an outflow for the water which inundates the land on either side of the line.

One of the greatest problems affecting the railway is the distribution and rapid movement of wagons for the sugar cane traffic. In 1928 there were 16, and in 1932, 19 large sugar factories on the system. Since then sugar production has grown rapidly, the number of factories in operation this year being 58, necessitating the running of about 2,000 more cane vehicles and wagons than were required in 1932. This rapid increase has caused a severe strain to be put on the company's rolling stock, and the administration is now finding itself called upon to decide what additional stock it will be necessary to provide to meet the increased demand. The season for cane is a short one and although mill owners are advised in good time to distribute their requirements of railed cane over the whole of the crushing season instead of concentrating, as they do, on the last two or three months, when traffic in general goods is at its highest, few of them have taken the advice given them which has greatly accentuated the problem of knowing what additional wagons are required. Such wagons would lie idle and could not be utilised profitably during the remaining nine months of the year. The production of sugar would appear to have reached saturation point, and as Government has imposed an excise tax of one rupee and five annas per cwt. on the commodity, this should put a stop to the erection of new factories.

Enormous sums of money are lost to Indian railways due to people travelling without tickets. The matter has from time to time received the consideration of the Railway Board and of the Indian Railway Conference Association and it is found that until legislative measures are passed making the offence of travelling without a ticket cognisable, there is no way of dealing with the problem effectively.

The Behar Earthquake

On January 15 of this year, an earthquake, the most severe that has been recorded in this country, caused serious and extensive damage to parts of the system, chiefly in North Behar, on the State portion of the line. Although little damage was done to rolling stock and no trains were derailed or capsized, which would have caused serious loss of life, the number of culverts and bridges, large and small, severely damaged or destroyed was 361.

On about 900 miles, or a little less than half the total system, hardly a mile of track was undisturbed. Embankments settled and in places disappeared entirely, the rails remaining suspended or being raised or shifted many feet laterally. Whole trains were marooned in some of the affected areas and could not be set in motion until the line and bridges had been repaired. This depleted the company's available rolling stock at a time when it was greatly needed. Both before the earthquake and for a considerable time afterwards, cane traffic was abnormal, general traffic was at its highest and in addition to this, relief stores had to be transported urgently to Behar and Nepal, a country which had also suffered severe damage from the catastrophe. For a time, the problem of moving traffic required careful handling.

From surveys which have been made by Government, it is found that there has been a general sinking in the

levels of the country in North Behar, the depth varying from 1 to 3½ ft. It remains to be seen how these changed levels will affect the courses of the rivers and their flood levels. The total amount of damage done to the railway system by the earthquake is reckoned to be about Rs. 25 lakhs.

An indent for eight new locomotives has been placed for delivery this year and twelve more have been provided for in the programme for 1935-36. Estimates have been prepared for constructing a chord line between Chakia and Sidhwalia across the Gundak river, a project which is an urgent necessity not only to facilitate hand-

ling of traffic between Behar and the west but also to relieve dense congestion on the main line bottle-neck between Hajipur and Chupra. The estimate for the project, which involves a capital expenditure of about Rs. 46 lakhs, has been submitted to the Railway Board, whose sanction is awaited.

As regards the general outlook, prospects for local traffic and traffic to other parts of the country are bright, the import of food grains being likely to be heavy. Coaching traffic has declined for several years past but it is thought that the trough of this depression has now been reached.

ROHILKUND AND KUMAON RAILWAY

Unusual problems which face this company are the number of persons travelling without tickets and attempts to cut embankments to provide an outlet for flood water

THE area served by the Rohilkund and Kumaon Railway comprises the sub-montane tract which extends for a distance of some 250 miles between the Nepal border on the north-east and a line drawn roughly from Lucknow through Shahjahanpur and Bareilly to Moradabad on the south-west.

The system is metre gauge, and covers 571 route miles, the principal cities served being Lucknow, Bareilly, Moradabad and Shahjahanpur, at each of which places it connects with the East Indian Railway, the Bengal & North Western Railway being in addition co-terminous with it at Lucknow.

The line traverses flat country, except where branch lines approach the foot hills of the Himalayas, where there are fairly severe gradients, the steepest of which is 1 in 70.

The branch lines are largely in what is termed Terai country and in Government forests where, during and after the monsoon season, malaria causes heavy casualties among the staff and adds considerably to the wage bill.

There are numerous bridges on the system, the largest of which are over the Ganges, Ramganga and the Sarda rivers. These rivers run in alluvial plains, and owing to the way in which they are liable to change their course during floods, measures have to be taken to train and hold them to prevent the bridges being outflanked. In the neighbourhood of the hills the rivers emerging on the plains are subject to very sudden and heavy spates, during the occurrence of which they have a great tendency to shift their courses. To protect the railway embankments from these rivers, extensive and costly protection works have been necessary and there is considerable recurring expenditure in their maintenance.

During the flood season attempts are not infrequently made by villagers to cut the embankments to provide an outflow for the water which inundates the land on either side of the line, to prevent which police patrols have to be posted in certain areas.

There are no minerals on the system and all coal supplies for locomotives, &c., have to be brought from Bengal and Behar and Orissa, which makes the cost of the coal about three times what it is at the pithead.

In common with other railways in India this line suffers regular and considerable loss on account of persons travelling without tickets or with short journey tickets, and although measures are taken to deter people from indulging in what has become an habitual nuisance, no effective remedy will be found for dealing with the problem until the offence is made cognisable under the Indian Railway Act. The principal commodities handled by the railway, and which form the largest exports, are sugar,

wheat, grain, pulses and timbers of all kinds, the imports consisting of salt, iron, steel, coal and general merchandise. There is considerable local traffic in sugar cane to the numerous large sugar mills.

On the coaching side, the principal difficulty experienced in recent years has been from uncontrolled motor bus competition. This, however, has been successfully countered by the adoption of a more frequent and speedier train service with close-timed connections at junctions, in addition to which return ticket concession fares, available every day of the week, have been introduced.

Perhaps the most difficult problem which the administration has to face is that of sugar cane transport. In the last two years the sugar industry has become established throughout the railway, there being eight large mills, to which large but uncertain quantities of sugar cane have to be railed in leads up to 147 miles, the average being 30 miles. This traffic is seasonal between November and May and overlaps the peak months for other traffic. Additional wagons have been provided to cope with the normal requirements of mills, but their demands are so variable that it is at times impossible to meet requirements for wagons; this will, however, rectify itself in time.

The gur or jaggree (product of boiling cane juice) export traffic has hitherto been a heavy one in full wagon loads over a long distance, but it is not unlikely that the demand for this raw form of sugar may fall off in favour of the refined factory sugar. So far there has been no falling off in this gur or jaggree traffic. In such circumstances the administration is faced with a difficult problem in the matter of additional goods stock. Four new locomotives have been provided for in the programme for 1935-36.

Two new construction projects involving a capital expenditure of about Rs. 37 lakhs are under consideration. The first is that of constructing a line from Mailani to Shahbaznagar, a distance of 39 miles, to take the place of a steam tramway which, during the war, was dismantled to release material and stock, &c., for military purposes. With the opening of the Sarda Canal, the trade in this area has increased and the project would greatly facilitate the movement of produce and be of great assistance to the populace, whose trading interests have been handicapped by the lack of rail communication.

The second project is the construction of a line from Kashipur to Kalagarh, a distance of 31 miles, to open up that part of the country and facilitate the extraction of forest produce from the Patli Dun. The district embraces large areas where sugar cane is now being cultivated, and as there are at present no good roads in the locality, the construction of a railway will be of material benefit.

HIS EXALTED HIGHNESS THE NIZAM'S STATE RAILWAY

Description of the system and of the road transport activities of this administration

THE largest railway in an Indian State is that now owned by the Government of His Exalted Highness the Nizam of Hyderabad. The railway connects at or near the State boundary with important adjoining railways at five junctions, thereby offering excellent facilities for the import and export trade of the State, and in addition providing portions of through routes between northern and southern India and between the east coast and the west.

The construction of the line was commenced about 1870 by the Great Indian Peninsula Railway, and the railway was acquired in 1885 by an English company and thereafter worked and developed by it until in 1930, when the route mileage of the system had increased to a total of 1,180 miles, the purchase of the line by the Government of the State was negotiated. Since then further extensions have been made, and the present mileage is 1,290, of which 667 is 5 ft. 6 in. gauge and 623 is metre gauge, excluding two short sections in British India, aggregating 58 miles, worked by the Nizam's State Railway for the Government of India.

It is interesting to see how the railway is adapted to the needs of the State. At the centre of the system are Hyderabad, the Capital of the State, and Secunderabad, one of the largest cantonments in India, which together have a population of nearly half a million, the population of the whole State being about fourteen and a half millions. The line running roughly west from the centre, is the main connection with Bombay, and the line running east serves the important colliery area at Singareni and connects with the main Madras-Calcutta line at Bezwada. The north-west metre gauge line serves the fertile cotton growing region of the Godavari Valley and provides an outlet for its produce by another connection for Bombay. The lines running roughly north and south are all of comparatively recent construction, that running north from Kazipet is an important link in the shortest route between Madras and Delhi and also serves another colliery at Belampalli. That running south from the centre links Hyderabad with southern India and provides means of access to the ports of Bombay and Mormugao for the oil seeds grown in the area it traverses. The remaining lines may be classed as feeders.

The system provides main line rail transport facilities which compare favourably with those of other parts of India, although the actual traffic density is comparatively low. Important special problems involving attention at present are the future feeder railway construction programme, the development of road transport by the State, and the co-ordination of road and rail transport under the railway administration with a view to the best possible utilisation of existing facilities and to their development without the waste resulting from uneconomic competition which has been so evident in many countries with the rapid growth of road transport.

The feeder problem is being dealt with on ordinary lines, but the development of road services deserves special reference. By sponsoring co-ordination of road-rail transport under the railway administration, H.E.H. the Nizam's Government have shown that they are able and willing to deal with one of the major transportation problems of the present day. In 1932 a start was made with a fleet of 27

vehicles operating 2,300 bus miles a day, and the fleet has now been increased to 65 vehicles operating 5,200 bus miles a day. These services yield a return of about 8 per cent. per annum on capital, in addition they have proved successful in free competition with private services. H.E.H.'s Government's policy has been justified by frequent requests from the public and local authorities for extensions of their road services, and there is ample evidence that the present services covering nearly 600 miles of road have firmly established themselves in popular favour owing to their regularity, fixed reasonable fares, comfort and reliability. Experimental parcels and goods services are being inaugurated, and the next question to be tackled will be through booking by road and rail.

A few of the more important financial and operating figures of this railway are shown in the table below. They

Particulars	1931-32	1932-33	1933-34
1. Capital outlay (in crores) Rs.	13.87	14.66	14.78
2. Gross earnings (in lakhs) Rs.	217	203	209
3. Operating ratio (percentage of revenue expenses to earnings) ..	56	56	58
4. Net earnings (in lakhs) Rs.	95	88	89
5. Percentage of net earnings on capital outlay ..	6.83	6.04	6.00
6. No. of passengers originating (in millions) ..	9.26	8.51	7.71
7. No. of passengers carried (in millions) ..	9.59	8.83	8.02
8. Passenger miles (in millions)	357	338	327
9. Passenger earnings (in lakhs) .. Rs.	59.6	59.1	57.3
10. Average rate charged per passenger per mile Pies	3.21	3.35	3.36
11. Average lead of a passenger Miles	37	38	41
12. Total coaching earnings (in lakhs) .. Rs.	71.6	71.0	69.5
13. Coaching train miles (in thousands) ..	2,217	1,942	1,920
14. No. of tons originating (in millions) ..	1.6	1.6	1.7
15. No. of tons carried (in millions) ..	2.1	2.0	2.1
16. Ton miles (in millions) ..	352	325	329
17. Average rate charged per ton per mile .. Pies	7.63	7.57	7.88
18. Average lead of a ton of goods Miles	166	162	154
19. Goods earnings (in lakhs) Rs.	1.40	1.28	2.35
20. Goods train miles (in thousands) ..	1,361	1,323	1,354

Rate at Rs. 1 = 1s. 6d.

1 Crore = Rs. 100,00,000 = £750,000.

1 Lakh = Rs. 1,00,000 = £7,500.

1 Pie = 0.094d.

relate to the entire system of 1,348 miles worked by H.E.H. the Nizam's State Railway, i.e., the 1,290 miles owned by H.E.H.'s Government and two small sections, aggregating 58 miles, owned by the Government of India but worked by H.E.H. the Nizam's State Railway.

The railway though small compared with the major lines of India and therefore unable to experiment extensively, does its share in testing up-to-date methods, and recently placed in service the first locomotive in India fitted with a booster and a mechanical stoker. A series of tests with this equipment is being made which will be

of general interest when completed. Extensive housing schemes, with arrangements for adequate water supply and for sewage disposal, are in progress, and remodelling of locomotive-sheds and repair shops is being undertaken in order to improve existing facilities for maintenance of rolling stock.

NORTH WESTERN (STATE) RAILWAY, INDIA

An analysis of the measures taken to combat the effects of the world crisis on one of the Indian State systems

ON March 31, 1934, the route mileage worked by the North Western (State), the largest railway in India, totalled 6,950 miles, of which 6,156 are owned by the Government of India, 361 by private companies and 433 by Indian States. Altogether 6,264 miles are broad or 5 ft. 6 in. gauge and 686 miles 2 ft. 6 in.

No fewer than 1,714 miles of line or 25 per cent. of the total miles are strategic and therefore almost entirely unremunerative. In comparing the financial results of the North Western with those of other lines, this important fact must be borne in mind and also another, namely that the N.W.R. is, in respect of the 361 miles of company-owned lines, credited only with a fixed percentage of earnings determined years ago and upon an operating ratio much below the actual percentage.

Financial Results

During the year ended March 31, 1934, gross earnings for the first time in five years exceeded those of the previous year. This was due entirely to increased goods traffic for which improved movement of cotton to Karachi for export and several new sugar factories between Saharanpur and Delhi were largely responsible. The total increase in gross earnings was 3.26 per cent., but from passenger traffic they fell by 2.08 per cent. in spite of more third class passengers travelling. Due to the restoration of half the 10 per cent. cut in staff pay, working expenses increased, but nevertheless they amounted to only 61.43 per cent. of the gross earnings, which figure is, however, increased to 79.24 per cent. if appropriation to Depreciation Reserve Fund is included. In consideration of the handicaps referred to in the last few sentences of the last paragraph these results must be considered as very creditable.

Job Analysis

In April, 1933, the new Organisation Branch of the North Western Railway administration was inaugurated in accordance with the recommendations of the Pope Economy Committee. This branch, working in co-operation with the divisions and other branches, operates as a research unit in matters affecting working expenses. Its chief function at present is the conduct of detailed investigations, generally known as job analysis, on systematic lines which eventually will cover the whole field of maintenance and operation. The specially selected officer in charge is designated Deputy Agent (Organisation) and was a member of the Pope Committee.

Up to March 31, 1934, the following ground was being covered by job analysis:—

Engineering: Track maintenance, analysis of labour; works organisation and staff. *Operating:* Running sheds, shunting analysis and marshalling yard staff and also station staff. *Clerical:* headquarters and divisional offices, Controller of Stores and stores audit offices. *Workshops:* Analysis of staff, special processes and use of scrap material. *General Stores depots:* Analysis of work in five main depots.

The savings recommended totalled Rs. 27 lakhs a year, and those accepted Rs. 20 lakhs, while the savings already affected totalled Rs. 9½ lakhs a year. Time lag accounts for the difference between the first two.

Reduction of Fares

Pioneer among Indian railways, the North Western recently decided upon a bold experimental policy of reduction of all but very long-distance fares throughout the line, in an endeavour to combat road competition. It is still too early to say what will be the final result of this policy, but it is significant that the following are the extraordinarily low scales in force now and formerly:—

Distance	Fares per mile	
	Prior to December 1, 1933	Since December 1, 1933
Miles	d.	d.
1 to 50	0.3	0.25
51 to 300	0.25	0.23
Over 300	0.17	0.21

These are ordinary single fares, and the result has been reductions for all distances up to 480 miles and slight increases for all greater distances.

Cheap Fares

The former policy of increasing the number of cheap fares available has been continued, and it is estimated that they now bring in an increase in earnings of some Rs. 2,25,000 or nearly £17,000 a year. Individual fares and sections are examined monthly, and where no increase accrues the cheap fare is cancelled.

Road Competition

Suffering from having the Grand Trunk and other main roads paralleling its main and branch lines, the North Western has to contend with severe competition from road passenger transport, and of recent years in this area perishables are also being carried by road in large quantities instead of as formerly by rail. The issue of cheap tickets and improved timetables have secured encouraging results, which show that not only has the normal decline in passenger traffic been arrested, but the number of passengers has so far improved as to effect an increase in earnings on the sections affected.

Over shorter distances it is becoming increasingly difficult to combat lorry services, in spite of the introduction of reduced rates for smalls and in wagon loads. Some diversion of traffic back to the railway has been effected by (1) improving services, (2) running guaranteed vans, (3) relaxing conditions of packing and carriage, and finally (4) reducing rates, taking into account incidental charges at both ends. In most cases, however, the increase in

traffic carried has been insufficient to balance the reduction in rates charged. Much greater success could undoubtedly be achieved but for the extensive and indiscriminate overloading of lorries in spite of the efforts of the police to prevent it.

Engineering Works

During the last few years the principal engineering works on this system have taken the form of completing large bridges over the great rivers of Northern India, the Indus, Jhelum and Chenab, residues of the pre-1930 period of vast expansion. This, before the depression stopped it, had reached a figure of 300 miles of new line added to the North Western annually.

In addition many large bridges have been strengthened by regirding. Among them are the Sutlej bridge at Adamwahan (16, reduced to 8 spans of 250 ft.), the Indus bridge at Kotri (5 spans of 360 ft. and 1 span of 100 ft.), illustrated and described in *The Railway Engineer* of May, 1933, the Jumna bridge at Delhi (12 spans of 212 ft.), described in THE RAILWAY GAZETTE of August 11, 1933, the Jumna bridge near Kalanour (7 spans of 200 ft.), Tangri bridge (5 spans of 100 ft.), and the Kurram River bridge (11 spans of 100 ft.). So that in spite of the world financial crisis, there has been much improvement work in hand, to bring the various sections of line up to a standard of sufficient strength to take the modern standard locomotives.

ASSAM BENGAL RAILWAY CO. LTD.

THE open mileage on March 31, 1934, was 1306.41. The train mileage (excluding departmental) during 1933-34 was 3,398,317 against 3,246,101 in the preceding year, being an increase of 152,216.

The following statement shows the passenger and goods earnings for the years from 1928-29 to 1933-34.

Years	Passengers		Goods	
	No.	Amount	Tons	Amount
1928-29	13,691,700	89,81,000	1,773,000	1,19,07,000
1929-30	14,512,000	89,21,000	1,698,000	1,11,37,000
1930-31	12,628,900	79,44,000	1,676,000	1,11,58,000
1931-32	10,461,100	64,93,000	1,601,000	1,06,34,000
1932-33	10,311,800	59,40,000	1,391,000	92,57,000
1933-34	10,244,700	56,16,000	1,515,000	98,69,000

The country which the Assam Bengal Railway serves is mainly agricultural. Large areas are under cultivation of tea and jute. In recent years low prices for tea have necessitated drastic economy in the gardens and the purchase of stores, building material, manures and the engagement of new labour was strictly curtailed, with consequent reduction in railway traffic. When tea restrictions came into force the exports of tea diminished from 81,943 tons in 1932-33 to 63,247 tons in 1933-34, but the increased prices have brought a measure of prosperity to the gardens which is reflected in increased imports and larger movements of garden labour.

The jute industry has suffered severely from the world depression. Freight decreased from Rs. 13,11,351 in 1928-29 to Rs. 6,76,621 in 1932-33, but has increased to Rs. 8,14,260 in 1933-34. Areas which expected large quantities of jute and imported rice have grown sufficient rice for their own needs. The loss of purchasing power has very seriously diminished passenger travel and traffic in piece goods and merchandise. Failure of the rice crop this year has caused very large imports of rice from Burma but although this has brought increased traffic to the railway and the Chittagong railway jetties, it is unfortunate that it is on account of the impoverishment rather than the prosperity of the areas served. In the prosperous days of jute cultivation every available man was required in the fields, but with low prices and smaller cultivation men were willing to accept a few annas for boating jute long distances from field to market along the numerous rivers and channels with which the jute country is intersected. To meet this competition reduc-

tion in rates was necessary but so low was the labour rate that it was not altogether successful. With such economic depression in the principal sources of traffic economy had to be strictly exercised on the railway and capital expenditure was severely limited.

Outside agricultural produce the principal traffic originating on the railway is oil. The output of the Assam oil fields has continued to increase and the existing number of petrol and kerosene oil wagons has been insufficient to cope with the demand and fifteen additional wagons have recently been obtained from the Burma Railways making 133 in all. The total gallonage in bulk for the last two years is as follows:—1932-33, 14,742,880; 1933-34, 17,366,320.

Road competition has not so far seriously affected earnings, and what loss there is has been to a large extent offset by increased traffic in petrol due to the more extended use of motors in other parts of India.

The main line from Akhaura to Badarpur which was originally laid with 50-lb. rails is now being re-laid with 80-lb. rails released from relaying on the Great Indian Peninsula Railway. Signalling arrangements are being steadily improved, double wire interlocking being generally adopted as the standard practice for wayside stations and small junctions, and electro-mechanical interlocking with double wire signals and rod worked points for the important junctions.

The Burma Railways

The principal occurrence upon the Burma Railways during the last few years has been the construction of the great bridge over the Irrawaddy between Ava and Sajaing near Mandalay. It was opened in January last and consists of nine spans of 350 ft., one of 250 ft. and six of 60 ft. girders, designed to carry a single metre gauge track and a roadway cantilevered out on each side. The steel caisson foundations are bedded upon rock which occurs at a maximum depth of 104 ft. below bed level. Some 11,000 tons of steelwork were used in the girder work, caissons, &c. The completion of this bridge enables the former wagon ferry at the same spot to be closed, and links up the Mu Valley section with the main system. A through run of 725 miles from Rangoon to Myitkyina in the extreme north is now possible and great saving in cost of operation is secured. The Burma Railways system, with an aggregate route mileage of just about 2,000 miles, now consists of three, instead of four sections, each isolated from the other by a broad river.

RECENT RAILWAY DEVELOPMENT IN CHINA

DURING the last few years, due to the energetic efforts of the Ministry of Railways, much progress has been made in railway enterprises. The following is a brief summary of the work done between July, 1933, and July, 1934.

Completion of Canton-Hankow Railway

This railway, traversing many districts along both the Yangtze and Pearl Rivers, connecting with the Peiping-Hankow Railway, linking up the extreme south with the districts along the Yellow River, when completed, will certainly play a very important rôle in the communication system. Since the section between Shaochow, Kwangtung, and Chuchow, Hunan, has not as yet been constructed, through traffic of the entire line has not been established, thereby seriously affecting the national defence and economic development. In order to facilitate its completion, the Chu-Shao Construction Administration was established to take charge of the work. The section from Shaochow to Lohchang (50 kilometres) was first started and completed as far as Liputao (16 kilometres) and opened for transportation of material and for temporary traffic in February, 1933, and in August of the same year the entire section to Lohchang was completed.

Completion of Lunghai Railway

This railway, running from east to west, traversing the following provinces, Kiangsu, Honan, Shensi and Kansu, is one of the most important trunk lines. The line from Taipu of Haichow to Tungkwan (900 kilometres) was completed and put in operation long ago. Another line from Tungkwan to Sian (132 kilometres) is still under construction. The section from Tungkwan to Weinan (73 kilometres) has already been completed, and train service was inaugurated on July 1, 1934. Formation work of the line from Weinan to Sian (59 kilometres) is nearly completed; probably it will be finished and opened for traffic at the end of the present year. A branch line is being constructed from Taiyechwang of the Chung Hsing Coal Mines, reaching Tsao-Tung, near the Grand Canal, namely

the Tai-Tsao branch line, over thirty kilometres long. Most of the earth work and culverts have been completed. More than twenty kilometres of tracks have been laid. On the east terminus of this line, between Selientao and Laoyao, a temporary wharf and a breakwater are being constructed. Dredging has been done near the wharf, 266 metres by 1,050 metres. In May, 1933, a contract was signed with the Netherlands Harbour Works Limited to complete the work in eighteen months. The cost of construction is three million dollars. In addition to this, the eastern part of this line has been extended from Sinpu flag station to Laoyao wharf (28 kilometres). The section from Sinpu to Shukow station (21 kilometres) has been completed and put in operation.

Train Ferry Construction

The Tientsin-Pukow and Nanking-Shanghai Railways being separated by the Yangtze River, a through train service from south to north was impossible, therefore a train ferry was constructed to cross the river. Work commenced on December 1, 1930, and was completed in September, 1933. The first through train ran over this line on October 22, 1933.

Hanchow-Kiangshan Railway

This railway was constructed by the Chekiang Provincial Government. It starts from Se-Hsing, right bank of the Chientang River, westward to Yushan Hsien and Kiangse, and a branch line was built from Ching-Hua to Lanche. Since it was opened for traffic in March, 1932, business has been quite satisfactory. The Ministry of Railways regards it as an important step towards extending the line from Yushan westward to Nanchang, going directly to Ping Hsiang, again through the Chu-Ping Railway to connect with the Canton-Hankow Railway. For such purpose, the Ministry of Railways sent a group of men to undertake a stadia survey from Nanchang eastward to Yushan. This work has been completed, and the various construction work is now in progress.

ACCELERATING LOCOMOTIVE REPAIRS, F.M.S. RAILWAYS

WE have received from the Federated Malay States Railways two photographs (reproduced on page 32) which are of interest as illustrative of methods adopted to accelerate locomotive repairs. While the "belt" system is not applicable to small railways having small numbers of locomotives of different classes, yet opportunities of reducing time and labour spent in sectional work are often to be found.

The first illustration shows the axlebox section. The marking off table is on the extreme right, and is level with a roller runway along which the box proceeds in the course of the operations which have to be performed. The machine tables and benches are so arranged that a box can usually be slid into position and lifting is reduced to a minimum. It will be noted that the "marker off" stands in a shallow pit, and therefore does not have to stoop over his work. Boxes are first slotted and drilled. Keeps and brasses are then fitted at the benches seen on the left-hand side of the runway. Thence the box and keep passes forward as a complete unit. After further marking off the cheeks are planed and the box bored.

The second illustration shows a boshing tank, in which the engine is immersed for cleaning purposes to a

sufficient depth to permit all running gear being covered by the caustic soda solution. The engine is put in over night and the tank heated by steam blown down from an adjacent test boiler. On the following morning the locomotive is lifted out and thoroughly washed down with hoses. It is found that frames, &c., are sufficiently clean to enable the engine to go straight to the pit after being lifted off its wheels. Previously, frames could not be cleaned until the engine had been lifted, and valuable time is therefore saved. Certain parts require reboshing, as do all boiler mountings. These parts are loaded into and dipped in the tray shown in the left foreground. Reboshing constitutes no loss of time, as compared with previous practice, and it is found that all parts are distributed to their respective sections earlier than was otherwise the case. Needless to say, the system is not to be recommended where considerable time and money is spent on painting, as all paintwork which is submerged during the process is destroyed. On the Federated Malay States Railways, however, paintwork is not a fetish, as the destructive character of the climate renders re-painting necessary at every overhaul. No loss therefore is entailed in this respect by the practice described.

SOUTH AFRICAN RAILWAYS AND HARBOURS

A summary of the findings of the Granet Commission regarding South African Railways finance and organisation

AMONGST the most interesting events of the year has been the publication, in September, 1934, of the report of the Granet Commission, which was appointed in August, 1933, to investigate the financial position and the working of the South African Railways. The Commission was composed of the following: Sir Guy Granet (Chairman) and Herr Hans Meyer, as Member, with Mr. Charles Hood Sutherland and Herr Fritz Nobbe, as Assistants. The Commissioners began their work towards the end of October, 1933.

The Commission recognises at the outset the success achieved by the South African Railways Administration in meeting the special difficulties of operation caused by the geographical features of the country. The total of £13,000 a mile, even after allowing for the fact that the standard gauge in South Africa is 3 ft. 6 in. and that 884 miles of track are of 2 ft. gauge, compared favourably with that of any other countries the Commissioners know. After considering the question of organisation in all its aspects, the Commission concludes unhesitatingly that the existing system is the one best suited to the conditions affecting the railways and harbours in South Africa. It does not recommend any change in the main structure of the system organisation, but suggests some strengthening at certain points.

Under existing arrangements, the organisation of the General Manager's office at Johannesburg provides for the General Manager being assisted in his managerial functions by an Assistant General Manager (Technical), an Assistant General Manager (Commercial), and a Superintendent (Special Duties, Parliamentary). The existing arrangements provide that the two Assistant General Managers be of equal status. The divisional system of management is the main feature of the organisation. Under this system the principal functions affecting the work of the railways are grouped and, subject to the control of the General Manager, are placed in the hands of System Managers.

One of the weak points in this arrangement is, the Commission considers, that whilst the System Managers look to the Chief Civil Engineer, the Chief Mechanical Engineer, and the Chief Electrical Engineer as the final arbiters under the General Manager, in their respective technical spheres, there are no corresponding heads of departments on whom the System Managers can rely for guidance in connection with the operation of traffic and the separate and equally important matter of commercial activities. The duties of the Assistant General Manager (Commercial) in fact embrace practically all branches of railway business, other than technical and parliamentary questions and, in so far as his supervision covers commercial activities, it must, of necessity, be limited to the "indoor" aspects of the matter. The report stresses the importance of having an officer responsible for co-ordinating operating activities throughout the railway, as there are many phases of operation which cannot be dealt with by particular systems on a self-contained basis. It recommends accordingly the appointment at headquarters of a Chief Operating Superintendent, responsible to the General Manager, to co-ordinate the operating activities of the administration. An officer, with similar functions, had already been appointed with the title of Chief Traffic Manager. The

Commissioners approve this appointment but consider the title they have suggested to be more suitable, as that of Chief Traffic Manager suggests a combination of operating and commercial functions.

Appointment at headquarters is also recommended of a Chief Commercial Superintendent responsible to the General Manager, this officer to co-ordinate the commercial activities of the administration. Consequent on these recommendations the report favours the abolition of the positions of Assistant General Manager (Technical) and Assistant General Manager (Commercial). It also recommends the appointment of a Deputy General Manager, who will function as general assistant and, with the exception of matters of high policy, act on behalf of the General Manager in his absence. One of the reasons for this suggestion is that, the legislative capital being at Cape Town, the General Manager has to be stationed there during the parliamentary session which sometimes lasts over five months, and has, in consequence, to be absent during that period from his office in Johannesburg. Appreciative reference is made in the report to the benefits, both in efficiency and economy, achieved by different departments as the direct result of scientific research work, but it is suggested that the best results are to be obtained by a definite research organisation. The appointment of a research officer is therefore recommended, part of whose functions should be: (a) to discover and define the problems into which research is desirable, (b) to provide means for carrying out scientific research on railway problems, (c) to act as scientific consultant to the various departments, and (d) to keep the departments in touch with outside scientific and technical developments relative to their activities. Dealing with another form of research, the report calls attention to the importance of analyses of detailed operations.

Amongst other matters considered by the Commission were the closing of East London as an independent mechanical workshop, as a measure of economy, the work to be allocated to other workshops, and the rebuilding of the Pretoria workshops in the near future. The Commission is of opinion that there is a *prima facie* case for considering the question of concentrating repairs to steam locomotives and coaches at the Durban mechanical workshops and the discontinuation of this work at Pietermaritzburg; also, that the improvements contemplated at the Germiston wagon repair shop should be delayed until the possibility of, and the requirements for, introducing the progressive system of repairs, are clearly established. In regard to locomotives, it is considered desirable and possible for the number of classes to be reduced, and the opinion is expressed that about 20 to 25 standard classes of locomotives would meet adequately all the requirements of the South African Railways. It would take some time for this reduction to be accomplished. Commenting on the operation service of the railways, it is remarked that in the construction of locomotives, results have been obtained which have surprised and interested railway experts from other countries. Changes in the internal organisation of each workshop would, in the opinion of the Commission, result in improved output, and the appointment is recommended of two works managers under the Mechanical Engineer to supervise and control separately

the locomotive and the carriage and wagon branches. The Commission also recommends that the sleeper plantations belonging to the Administration should be disposed of at the best prices obtainable.

The Commissioners were impressed by the striking disproportion between the revenue contributed by the relatively small tonnage of high-rated traffic and that produced by the large volume of low-rated traffic. From all sides, of course, come claims for rate reductions. In view of the existing financial position of the undertaking, no change in tariffs is advocated, but the Commission is of opinion that in the event of the Administration receiving relief in respect of interest charges, the tariff policy as affecting the higher-rated classes of goods should be reconsidered, but there was no justification for a further reduction in agricultural rates. In this connection, the Commission considers that the interest charges of branch lines constructed since Union place an undue burden on the administration. The Commission did not definitely reject the suggestion of a Railway Rates Tribunal, but pointed out that—with the exception of the Canadian National Railways—there was no State-owned railway in the world where a dissatisfied party had the right to appeal to an impartial outside tribunal. This was recorded as a finding of fact and not as evidence that the demand for a right of appeal against rates was unreasonable. At the same time, the Commission considers that an independent tribunal would be unable, in present circumstances, to afford any relief to the railway user beyond that of giving him the opportunity of stating his case publicly.

On the subject of electrification the Commission holds the view that, apart from the possible extension of the existing electrification schemes, the density of traffic is insufficient to justify further large schemes of main line

electrification. It also advocates the policy of electrification.

The Commissioners strongly recommend the continuation of the policy of eliminating or easing the heavy gradients and sharp curves by the construction of deviations. Many suggestions of great value are made in the report, and in a special memorandum by Herr Meyer as to improvements in connection with the permanent way.

On the subject of economies, the report speaks appreciatively of the effective manner in which a very difficult situation was dealt with, but at the same time makes the pertinent criticism on the reduction of the number of supervisory officers that such measures, while showing a saving in the cost of supervision, have a tendency to defeat the object in view by increasing to a much greater extent expenditure in other directions and also to decrease efficiency generally. The training of technical officers and the standards required for engineering pupils receives special attention in the report itself and in an individual memorandum by Herr Meyer. Overseas visits by officers are also strongly recommended; they should be systematic and frequent, and of sufficient duration to enable the officers concerned to make a thorough investigation of the subjects entrusted to them. With regard to the employment of European unskilled labour, the Commission expressed the opinion that, provided the number of such labourers was kept within reasonable bounds, and the character of the work for which they were employed was strictly defined, their employment was not uneconomic.

Dealing with the Administration's road services on their merits, the Commissioners formed the opinion that the operation of these services has been justified and that the Administration, in introducing these developmental services, has considerably assisted in opening up new areas and stimulating agricultural development in other areas.

NIGERIAN GOVERNMENT RAILWAY

Reduced fares resulting in an increase of over two million passengers are among the points brought out in the General Manager's report for the past financial year

THE Nigerian Railway, which is 1,905 miles long, and has a capital of £23,000,000, is the largest of those in the Crown Colonies. Of the route mileage, 1,772 is 3 ft. 6 in. gauge, and 133, 2 ft. 6 in. gauge. The total track mileage is 2,188. The rolling stock comprises 273 locomotives, 327 coaching stock and 3,533 wagons.

Two ports are served by the railway: Lagos and Port Harcourt. In both of these the first increment of a deep-water quay and transit shed system has been constructed. That at the port of Lagos comprises four general cargo ship berths, and that at Port Harcourt similarly.

The principal passenger trains are the North and Ocean Mails, and the Western and Eastern Limiteds. The route mileage from Lagos to Kano is 705 miles, and from Port Harcourt to Kano 709 miles. During the financial year 1933-34, over five million passengers were carried. The reduction in 1933 of the third class fare to one farthing a mile has greatly increased travel, while suburban traffic is increasing very rapidly. The low third class rate also enables market produce to be brought in 56-lb. bundles into the cities and has thus augmented food supplies at a time when the earnings of the people are very low. Principal commodities hauled are groundnuts, tin, cocoa, hides and skins, cotton, palm kernels, kolas and general merchandise.

The recently issued report for the financial year ended March 31, 1934, reflects the personality of Mr. G. V. O. Bulkeley, the General Manager, as unlike most annual reports, which are so often a mere collection of data sent in by heads of departments, this is compiled on rather unusual lines, and is somewhat dogmatic in places. The most astonishing feature of the report is the rise in the number of passengers carried from 2,300,000 in 1932-3 to over 5,000,000 in 1933-4. This was the result of a reduction in the fare to ¼d. a mile third class, and appears to have been obtained without any material increase in train mileage. The receipts only rose £20,000 and the average fare fell from 1s. 6d. to 9d. The General Manager remarks: "Apart from an encouraging travel, these reductions have enabled market produce to be very cheaply conveyed in bundles by third class passengers, and are probably doing a great deal to keep down the cost of food to the African population of the large towns, during a period when their earning power is low." In a native country, to carry over 5,000,000 passengers a year out of a total population of 20,000,000 is a very satisfactory result.

Some of the figures in the report are presented in a new manner. From one of the tables it appears that the railway failed by £763,000 to meet its full liabilities for

interest and depreciation funds, although the proportion of every £1 of gross revenue available for payment of interest, and the contribution to Renewals Provision, rose from 8s. 5d. to 8s. 6d. As for the previous three years, no contribution was made to the Renewals Fund, and it is calculated that the fund is now short to the extent of nearly £2,000,000. The General Manager is arranging for a re-assessment of the railway capital assets on the basis that part of the capital expenditure should be regarded as money spent on the general development of the colony, and when this is done, if a Renewals Account is prepared as from the date on which the assets were put into service, a very much greater Renewals Fund shortage will become apparent. There is a very interesting section in the report on competitive road transport. Various steps were taken to combat this form of competition, which is largely in native hands, and in October, 1933, a flat rate of 2d. a ton mile, including terminals, was brought into effect on the first 300 miles of the railway, which runs through the most competitive zone. This attempt to attract traffic to the railway proved unsatisfactory. The price of petrol was reduced and so were the road rates. The result was that the railway carried almost exactly the same tonnage but obtained £16,000 less in receipts. The General Manager presses for area licensing authorities on the lines of the arrangements recently set up in Great Britain under the Road and Rail Traffic Bill.

Goods and Passenger Revenue

Figures are shown in the report of the revenue per coaching vehicle and goods wagon in service. In five years the figures have dropped from £1,600 a coaching vehicle and £650 a goods vehicle to £1,000 and about £490 respectively. Similar figures are given for locomotives, and in commenting on them the General Manager says: "The heavy decline in Nigerian trade is clearly evident. The lack of large locomotives and consequent double-heading also affects the earning power per locomotive. Their earning power is also affected by rate reductions. It is improving." The long haul ground nut traffic reached a record tonnage of 206,000 tons. Its average haul is some 600 miles, and the rate worked out at 1-39d. per ton mile. The growing of cotton in the northern provinces increased due to the decline in the demand for grain and food crops by the tin mines, which are now operating under a restricted output arrangement. The average length of haul was about 320 miles for freight traffic, comparing with about 328 miles in 1931-32, thus indicating the loss of short distance traffic. The net train loading showed a satisfactory increase. A review of the locomotive stock is taking place with a view to eliminating obsolete engines and avoiding double heading. The General Manager remarks in this connection as follows: "The functions of colonial railway workshops also arise. The colony is dependent for its development upon capital from Great Britain. Its purchasing power has heavily declined owing to trade conditions, and this has affected unemployment in Great Britain. It would appear logical for a colonial railway to purchase, as far as economically possible, at the source of its capital supply. That is to say, that the functions of colonial locomotive workshops should be maintenance and betterment rather than extensive rebuilds of old engines. On the carriage and wagon side, the use of colonial timber is desirable and rebuilds can be effected economically and with advantage to colonial production. A standard covered goods wagon body in Nigerian timber has been developed and can be rapidly constructed in quantity." In showing the details of the engine position on the Nigerian Railway,

the tractive effort at 15 miles an hour is given instead of the tractive effort at starting point, which is a new departure in this report. The General Manager visualises express diesel railcars running from Lagos to Ibadan (119 miles), the latter being one of the largest cities in native Africa, with a population of a quarter of a million. There are two main workshops on the Nigerian Railway, one at Lagos and the other on the eastern side at Enugu. Concentration of work is taking place at Lagos, and the other shops are carrying out running repairs only and working on short time.

An interesting section of the report deals with the appointment of the Research Assistant to the Chief Mechanical Engineer, and some of his work will be of value not only in Nigeria but on other colonial railways. Dealing with job analysis, the General Manager writes: "The outstanding success of the 'job analysis' policy of the London Midland & Scottish Railway, and its adoption by the Indian railways, show clearly that routine staff have not the time fully to analyse detail or to follow up experimental work. If this is not someone's special duty it is not done, and important economies are missed. This is also very fully recognised by motor vehicle manufacturers. While the depleted staff of the railway will not allow of a full job analysis committee to investigate all departmental work and clerical activities, it is intended to do this from time to time under the chairmanship of the Principal Assistant to the General Manager." In accordance with policy, many posts on the railway are being filled by men of African descent, and remarkable progress is shown by the following figures of native staff: Station masters, 100 per cent.; guards, 94.5 per cent.; locomotive drivers, 53 per cent. It will be realised that the work of training Africans is of very great importance and requires considerable organisation. The report shows that expenditure fell in all departments.

An interesting change in the organisation of the railway has been made which is fully referred to elsewhere in this issue. In 1924 General F. D. Hammond recommended that the divisional system should be applied in Nigeria. This was done in 1926 and the line operated in three divisions in charge of divisional superintendents responsible for commercial, operating, motive power, carriage and wagon, and miscellaneous machinery, plant and equipment activities. This system of organisation has now been replaced by a modified form of departmental organisation based on that in force on the Great Western Railway, by which company the General Manager was for many years employed before joining the Colonial railway service. The General Manager's memorandum refers to the conditions under which the divisional system is successfully exploited and states a reasoned case against its application to Crown Colonial requirements. The question is one which must depend largely upon local conditions, and it is therefore reasonable to accept the judgment of the man on the spot.

The report shows that the gross receipts for the year ended March 31, 1934, amounted to £1,885,660 in comparison with £1,899,050 for the previous year, and that expenditure was reduced from £1,111,126 to £1,086,125, bringing the operating ratio down from 58.50 per cent. to 57.59 per cent. As already indicated there was a striking advance in the number of passengers carried—from 2,377,938 to 5,179,206, although total passenger receipts increased only from £178,460 to £198,606. Although the tonnage of goods fell from 646,054 to 627,475, the average receipt per ton rose from 49s. 11d. to 50s. 6d. Compared with 1931-32, gross receipts have risen by £16,141 and expenditure has been reduced by £105,322, resulting in a great improvement in the operating ratio.

KENYA AND UGANDA RAILWAYS AND HARBOURS

The Railways, Harbours and Lake Steamers in Kenya and Uganda have been under one Administration since 1926. Until fairly recent times Uganda itself had no railways actually in its territory

AS stated in the Annual Report of the Kenya and Uganda Railways and Harbours for the year 1933, the future of this service depends upon a gradual return to normal business conditions and upon the ability of the Administration to keep the operating ratio at 47 per cent. or thereabouts. The past year was uneventful, and all the efforts of the Administration were devoted towards operating efficiency and the lowest possible working costs. On the technical side, however, two features have been put into operation in the Administration's workshops, the following details of which may be of interest.

Crank Pin Truing Machine

The machining of locomotive crank pins has recently been the subject of investigation in the workshops of the Kenya and Uganda Railways and Harbours Administration at Nairobi. Having in mind the sharp curves and general operating conditions on the lines, crank pin wear has always been considerable. The problem has been, therefore, to true up the pins in position and to ensure that when completed they shall be in correct angular phase and that the amount of the throw shall also be correct. The whole to be accomplished in as short a time as possible.

The financial position does not permit of the provision of a special quartering machine even if the number of wheels handled warranted this. It has, therefore, been necessary to design a special machine for the purpose.

This machine is now under construction in the Nairobi workshops. The wheels to be handled are first placed in jack stands and the correct position of the crank pin is marked off. If the crank pins are to within $\frac{1}{32}$ in. of their correct position for either "angularity" or "throw" and in addition the pins themselves are less than $\frac{1}{64}$ in. over they are allowed to pass; if these limits are exceeded the pins are machined.

The machine consists essentially of a tool holder rotating in a housing attached to rails laid on the marking off table. This tool holder derives its motion from a piston valve boring head altered for the purpose and bolted to the rear end of the housing. Power is provided by a 1-h.p. electric motor running at 940 r.p.m., the tool cutting speed and feed being from 18 to 35 feet per minute, depending on the size of the pin, and 3 in. per minute respectively. The floor to floor time per pair of wheels, including marking off and machining, will, it is estimated, be $1\frac{1}{2}$ hours. This method of handling crank pins ensures their accuracy at a capital cost which is comparatively trifling. It may be mentioned that it is intended eventually to provide additional equipment to obviate marking off.

Casting of Bronze Liners and Bearings into Steel Axleboxes

The majority of the locomotive stock on the Kenya and Uganda Railways and Harbours Administration is fitted with steel axleboxes, having renewable bronze bearings and face and side liners also of bronze. Users of this type of axlebox are familiar with the difficulty of maintaining the brasses and liners tight for any length of time. Furthermore, the fitting and machining operations entailed are

both lengthy and costly. In order to overcome these objections trials have been carried out in Nairobi shops involving the chill casting of the bronze bearings and liners in position in the axleboxes. A considerable number of axleboxes has been treated in this manner and are now under engines. The resulting saving in machining and fitting time, coupled with increased efficiency of the work, are such that arrangements are now being made to turn over to the new system entirely.

In order that the expense entailed in the preliminary stages should be as small as possible, the equipment used for chill casting has been made up of independent cast-iron plates. The following is a description of a new cast-iron box mould which is being designed and built at Nairobi shops with a view to placing the work on a permanent footing. It differs not at all in principle from that employed in the experimental stage.

In order to cast the liners and brass the axlebox lies, with the side on which the face liner is to be cast downwards, on a cast-iron chill plate. The side liners are formed by cast-iron plates hinged to the bottom. The sides and top form a box mould surrounding the axlebox to be treated. In order to enable the liners and brass to be cast in one operation, holes are drilled in the sides of the axlebox which serve to connect the bearing to the side liners, also further holes are drilled in the axlebox flanges, those in the lower flange being provided with the object of locking the side liners to the face and those in the upper flange with the dual purpose of securing the side liners and also to act as risers.

It has been necessary to provide a sand core in order to make the white metal pockets in the bearing, as owing to their shape a metal core could not be withdrawn. The new scheme also includes for the provision of a drilling jig, so that when the worn axleboxes ultimately come into shops for re-conditioning, the old liners and bearings may be freed by drilling the bronze out of the locking holes previously described.

The new method calls for the creation of a small stock of axleboxes at the running sheds since the latter cannot renew bearings on liners, but will require to send them to the headquarter shops for this purpose.

It is, however, confidently expected that axleboxes handled in the manner described will be less liable to heating than hitherto.

Results for the year 1933, both of the railways proper and of the combined railway, harbour, and steamship services, showed a great improvement on those of 1932. Combined earnings amounted to £2,426,184, an increase of £305,169 or 14.39 per cent. Ordinary working expenditure, exclusive of contributions to Renewals Fund on account of depreciation, amounted to £1,121,145, a decrease of £48,240 or 4.13 per cent., which reduces the operating ratio from 55.13 per cent. to 46.21 per cent. The gross surplus of £1,305,039 is the largest yet recorded, and the net surplus for the year under review, after covering interest and sinking fund charges, amounts to £232,836, and compares with a deficit of £189,388 in 1932. On the working of the railways there was a net surplus of £262,818 in 1933, against a deficit of £114,581 in 1932.

GOLD COAST GOVERNMENT RAILWAY

Besides operating a system of Government Railways on the 3-ft. 6-in. gauge, the Gold Coast Railway Administration has charge of the new deep-water harbour at Takoradi

THE construction of a railway in the Gold Coast Colony was first contemplated in 1879, but it was not until 1896 that any active steps were taken towards a realisation of the project. By that time the gold mines in the Tarkwa area were attracting considerable attention, and a survey of the country between Sekondi and Tarkwa was carried out by Mr. (later Sir) William Shelford. The choice of a terminus lay between Sekondi and Takoradi, and although the advantages of Takoradi as a situation for a deep water harbour were recognised, the traffic prospects as they were then did not warrant the expenditure on a deep water quay, and Sekondi was selected as a lighterage harbour.

Construction of the railway commenced in 1898, but labour was scarce and efforts to recruit from neighbouring West African colonies met with little success. Finally, the last Ashanti war broke out and work on the railway was suspended until the conclusion of hostilities in 1900, and it was not until May, 1901, that rail-head reached Tarkwa. The construction of a deep water harbour at Takoradi was begun in 1921, and on November 8, 1926, the first ship entered the harbour. The harbour was formally opened on April 3, 1928, and is administered by the Railway Department.

Route Mileage

The Gold Coast Railway now consists of 490 route miles of 3 ft. 6 in. gauge single track, and 10 miles of 2 ft. 6 in. gauge. The route traverses the country between Takoradi and Kumasi, and Kumasi and Accra, with a Central Province branch line of 99 miles from Huni Valley to Kade, and a further branch line of 18½ miles from Tarkwa to Prestea to serve the gold mines in that area. The main line from Takoradi to Kumasi is laid with 80 lb. material and the remainder of the line with 60 lb., except between Accra and Tafo (a distance of 64 miles) and the Prestea branch, where 45 lb. rails are employed. Half of this light track is due for replacement, and will be relaid with 60 lb. materials in the course of the next two or three years.

The system of train working in use is the electric staff, and train control telephones are installed between Takoradi and Kumasi to facilitate train working and the distribution and supply of trucks and engine power. A daily mail train runs between Takoradi and Kumasi, the running time being 8½ hours; while another mail train runs daily between Accra and Kumasi, the journey occupying 10 hours. A number of local passenger train services are operated where the traffic warrants, and Sentinel coaches are run in the Kumasi (Ashanti) district.

Passenger Traffic

In common with other parts of the world, the number of passengers carried has fallen considerably in recent years. The reason is twofold: (1) the shortage of money, due to the great fall in the value of produce; and (2) the inroads of motor competition. Another factor which has reacted adversely on the revenue of the railway is the incidence of the third class fare, which has been maintained at 1d. plus 15 per cent. a mile. From September 1, 1934, third class fares throughout the greater part of the line have not exceeded one halfpenny a mile, and in certain districts short-distance fares are now as low as three-eighths of a penny a mile.

The number of passengers carried during the financial year ending March 31, 1934, was approximately 1,000,000, and the revenue derived from this traffic was £105,000. Passenger traffic, however, does not bulk largely in the revenue of the railway, but commodities such as cocoa, manganese, mahogany, mining machinery, and wood fuel are the mainstay of the railway. It is gratifying to record that just as the world depression of 1931-33 had its repercussions in this colony, the revival of trade is having its effect here also, and there is every indication that a period of prosperity, and consequently of development, may be confidently expected.

Cocoa Production

The Gold Coast Colony and Ashanti, although not covering an extensive area as distances go in Africa, are peculiarly rich in agricultural and mineral resources. It is forest country, with a good rainfall, and is eminently suitable for the cultivation of cocoa. In 1910 the tonnage of cocoa carried on the railway did not exceed 2,000 tons. By 1920 this figure had risen to 95,000 tons, and by 1930 to 133,000 tons. This tonnage, however, does not represent the total quantity of cocoa exported from the Colony, as a further 70,000 tons reaches the subsidiary ports of Accra, Cape Coast, Saltpond, and Winneba by road transport. The Gold Coast is therefore in the forefront of the world's cocoa producers.

As to the mineral wealth, the gold which acted as a lure to the Portuguese, the Dutch, and the British adventurer for centuries back, is again attracting the attention of enterprising prospectors; but in this year of grace the geologist, the trained mining engineer, and the specialist in metallurgy have replaced the "old-timer," and with the aid of roads and railways, which provide transport at a comparatively low cost, are adding their quota to the prosperity of the Colony. The principal gold mining areas now being exploited are Tarkwa, Abosso, Prestea, and Obuasi; but systematic and sound development is taking place also in areas served by roads feeding the railway at Insu, Dunkwa, Konongo, and Oda. On the Central Province line, near Wenchi, commercial diamonds are successfully exploited and exported to Europe.

Manganese Ore

Another important mineral traffic is that of manganese. The deposit of manganese ore at Nsuta (36 miles from Takoradi) was discovered by the Geological Survey Department of the Government in 1914. Up-to-date methods of winning, grading, and shipping have been introduced by the African Manganese Company, whose plant is one of the outstanding features of Takoradi harbour. In 1929 over half a million tons of manganese ore were railed and shipped, and while in recent years there has been a decline in the tonnage carried, the revival of trade has led to a substantial increase in the demand for manganese, and it is not improbable that in the near future all previous records will be broken. The manganese is hauled in train loads of 750 tons gross, in trucks of 25 tons capacity. Another traffic which has revived greatly in 1934 and will in all probability outstrip all previous records shortly, is that of mahogany logs. 5,000 tons were railed in the year 1933/34, and this figure is likely to be trebled in 1934/35. Summarised, therefore, the prospects of the Gold Coast Colony, and therefore of the Gold Coast Rail-

way, are most promising. In order that the railway may be in a better position to deal expeditiously and efficiently with this growing traffic, arrangements have been made to transfer the railway headquarters from Sekondi to Takoradi. Sekondi, which is situated six miles from Takoradi, was until 1928 the railway terminus; but with the opening of the deep water harbour the main activities of the railway have moved to Takoradi. This re-organisation will result in improved co-ordination between the railway and the port. The railway workshops and general stores must necessarily remain at Sekondi, but a close liaison will be maintained by means of telephonic communication. There is no disadvantage in having the workshops situated some distance from the sea, as the excessive humidity has a deleterious effect on machinery.

A further provision which has to be made for the increased traffic anticipated is the renewal of rolling stock. This has had to remain in abeyance for the past three years, but is now under consideration in connection with the budget for 1935-36, and it is hoped to have 32 new

open bogie trucks on the line by the beginning of the financial year 1935/36. It is also proposed to seek funds to construct an engine shed capable of accommodating 30 or 40 engines at Takoradi, a provision which was omitted, due to the shortage of money, when the harbour was under construction. The locomotive depôt at Tarkwa is already inadequate, but will not be extended, as the operating will be concentrated at the Takoradi headquarters.

Other evidence of the progress achieved by the Gold Coast Railway is to be found in the following figures:—

In 1903 the earnings amounted to	£	66,000
.. 1913	"	360,000
.. 1923	"	1,012,000
.. 1933	"	796,000

In the latter year the colony and the railway had not recovered from the setback suffered in 1931, but the prospects for the financial year 1934-35 justify confidence for the future.

EGYPTIAN STATE RAILWAYS, TELEGRAPHS AND TELEPHONES

A vigorous policy of development is being pursued by the Administration, both in the encouragement of traffic and in measures of economy. New workshops have been opened, and increasing use is being made of railcars

THE financial position of the railways is very satisfactory, particularly having regard to general world conditions. The statement below shows the situation for the past three years. The financial year is May 1 to April 30. The pound Egyptian (L.E.) = £1 0s. 6d.

	1931-1932	1932-1933	1933-1934
	L.E.	L.E.	L.E.
Gross receipts ..	4,939,030	4,742,873	5,202,738
Expenses ..	3,623,999	3,273,530	3,495,719
Net receipts ..	1,315,031	1,469,343	1,707,019

It will be noticed that net earnings show a considerable increase. This result has been achieved by drastic economies in working expenses, and a steady policy of reduction in passenger fares and goods rates wherever such reductions appeared to be indicated by the loss of passenger or goods traffic to the roads and waterways. Innovations include summer-time cheap excursions to the seaside resorts, which proved most popular, trains having to be run in two and sometimes three portions. In winter similar excursions were run to Luxor, in trains adapted to allow of passengers lying down, as the 12 hours' journey is performed at night.

Express trains, between Cairo and Alexandria, timed at 2½ hours for the trip, at hours suitable for business men, have proved popular and successful. These trains are "de luxe," and a small supplement to the ordinary fare is charged. Train services have been speeded up in all directions, and fares reduced to practically pre-war levels, resulting in a sufficient increase of passenger movement to compensate for the very considerable surrender in earnings.

Simplified Goods Rates

On the goods traffic side, a start has been made with containers, for furniture transport. A number of "flat" rates have been introduced, chiefly for traffic from ports; and in the case of refined sugar, a "universal" rate, based on average traffic for some years previous, by which the sum charged is dependent upon weight alone, irre-

spective of distance, has been instituted, and is working very satisfactorily to both railways and manufacturer. Study is now being made of a proposal for the wholesale simplification of the goods tariff.

The Way and Works Department is about to experiment with a few butt-welded rail lengths, which will mean rails 36 metres (120 feet) long instead of the 12 metres (40 feet) standard length now in use. Should the experiment prove successful, and the use of long rails extended, considerable economy in maintenance is expected. Arc welding, for building up worn-out crossings, is now in general use.

New Workshops

The Locomotive Department has put the new locomotive workshops into use. These shops, designed and equipped on the most modern lines for "progressive" repair work, are situated on the desert about 15 miles from Cairo. At present most of the workmen are taken in and out by train, but the full scheme envisages a model township. The shops are electrically operated, from an 800 kilowatt power installation, which, in addition to operating and lighting the shops, provides the power for the recently inaugurated State Broadcasting Service.

Steam railcars, of which the railways now run 21, have proved their utility and economy for short distance and branch line traffic, and, in continuation of this policy, a further 10 cars are on order from the Sentinel Company. Ten internal combustion (diesel) railcars are also to be acquired, and the order has been placed in Hungary.

With the view of increasing adhesion, and so improving acceleration, an experiment was made of converting a standard 4-4-2 Atlantic passenger locomotive to a 4-6-0. The result was completely successful, and nine more locomotives are now in process of similar conversion.

The fleet of motor omnibuses, operated by the railway in situations where road competition was becoming very severe, is about to be enlarged by the purchase of 30 additional vehicles.

THE SUDAN RAILWAYS

River services on the Nile form an important part of the operations of the Government Railways Administration. They provide communication at Shellal between the Egyptian State Railways and the railways of the Sudan

THE Sudan Railways are owned by the Sudan Government and managed on its behalf as a Department of that Administration. The Department not only administers the Government railways but also the ports of Port Sudan and Suakin and river services over 2,325 miles of the Nile and its tributaries. The route mileage of railway operated is 2,021, and the track mileage 2,240; the gauge being 3 ft. 6 in. The railway owns 160 locomotives, of which 32 are shunting engines, 307 carriages, 2,115 goods vehicles inclusive of all tank wagons and other special vehicles, 41 river passenger steamers, 2 i.c. engined passenger vessels, 19 tugs inclusive of 5 port tugs, 31 launches, 186 barges, and 165 miscellaneous craft.

British staff are employed in supervisory posts only and number 202; 17 members of other Northern European nations are employed, largely in connection with hotel and catering services. Greeks and Maltese number 60. Egyptians, Syrians and Armenians number 813, of whom all except nine are Egyptians. Natives of the Sudan number 11,084, and there are 63 members of other tropical African races.

The most satisfactory year financially was 1929, when revenue from all sections totalled £2,549,582 (£1 = £1 0s. 6d.), and the ratio of working expenditure to earnings was 64.4 per cent. In 1933 the effects of the world economic depression resulted in the total revenue being reduced to £1,737,142 and the ratio of working expenses to earnings was 70.0 per cent. In both cases the ratio of working expenses to earnings is arrived at after making full debit to the former for depreciation calculated on the estimated life of the assets.

A definite and increasing improvement in economic conditions in the Sudan which began to become apparent towards the end of 1933 makes it reasonably certain that the financial results for 1934 will be substantially better than those for 1933, but apart from the recovery attributable to improved economic conditions, the commencement of work on behalf of the Egyptian Government on the new dam which is being constructed on the Nile at Gebel Aulia is bringing additional revenue to the Sudan Railways.

Economies and Betterments

Provided there are no crop failures in the Sudan and that a decline in world prices does not occur, further progress towards recovery may be anticipated in 1935. The world crisis which began to have its effect upon the Sudan during the second half of 1930 necessitated drastic reorganisation and retrenchment in the Railways Department, but every care was taken to endeavour to minimise its effect upon the native staff and to distribute the reduction in numbers as evenly as possible between the various nationalities comprising the personnel. Present numbers represent approximately 75 per cent. of those employed prior to the crisis.

During the past twelve months no relaxation of the demand for the strictest economy in all branches of the service has been possible, but advantage was taken of the reduced costs of labour and materials to carry out a certain amount of betterment work, especially on hotels which were no longer up to modern requirements, so as to be ready for the time when traffic should recover.

The increase in the size of vessels using Port Sudan also rendered it expedient to provide greater tug power at that port and a new vessel of 1,100 i.h.p. was ordered from England and is now on its way out. For the Nile River services one new medium sized shallow draught vessel, 115 feet over all and 21 feet beam was built and brought into service in replacement of a condemned steamer. She is of the usual stern wheel type but fitted with Gardner 6 J 6 type engines and is the fourth i.c. engined vessel to be put into service.

Workshops

The Mechanical Department's main workshops in Atbara were enlarged by an additional covered floor space of 23,000 square feet, which has made possible an improved shop layout including a new spring and chain shop and new tube reclaiming plant. Out of date wool waste washing and oil recovery plants were replaced by new. An oxygen plant is in process of installation and the works will soon be producing its own requirements of oxygen and hydrogen. A small chromium plating plant for plating the letters, numbers, and fittings used on and in passenger stock was installed.

On the 2 ft. gauge Tokar Trinkitat Light Railway which is a part of the Sudan Railways System 3 90 h.p. diesel locomotives were put into service for the 1933 cotton crop and gave satisfactory results. A 190 h.p. diesel shunting engine for the main system is now on order.

A year ago the bodywork both inside and out of a saloon was constructed with Masonite as an experiment. The results were so satisfactory that the same construction is now being followed in the case of two sleeping cars. With the exception of a certain number of all-steel coaches bought complete from England only the underframes of coaches are purchased in England and the bodies are constructed in Atbara. The latest underframes have roller bearings.

Spray painting for steel wagons has been introduced but the economy achieved thereby is less than in England owing to the lower labour rates ruling in the Sudan.

In the Electrical Section a 300-kW. set is being added to the Atbara power station. One new five ton and two new 3 ton electric cranes are on order for the Port Sudan quays in replacement of plant which has served its useful life. All are level luffing and have a working radius of 66 feet. An electric light plant and ice machine have been provided for the hotel at Juba 1,100 miles south of Khartoum on the Nile. Electric emergency protective devices were installed throughout the Atbara Works.

In the Civil Engineering Department there has been but little new works development as a whole during the last 12 months, attention having been necessarily devoted to maintenance works with reduced staff and reduced expenditure. The construction of 4 additional bridges and a large amount of stone pitching to railway banks was undertaken on the Northern District to minimise damage through washouts during the rainy season.

Track Improvements

Track improvements that have been brought into use are the adoption of 2 4-hole fishplates on the lines of the

American Railway Engineers' Association standards for 75 lb. per yard track in place of the angled and flat fishplates which were standard formerly. The fishbolts have been improved and a larger length adopted to allow of a spring lock washer being used with them. The standard bearing plate for 75 lb. track has been amended as regards hole centres to allow of joint sleepers being placed closer to the end of the rails. The strengthening of the joints by the adoption of these improvements is expected to afford better riding conditions and ultimate economy in track maintenance. Two rail and flange lubricators have been installed on the Port Sudan-Gebeit section with a view to minimising rail wear on the curves ($3\frac{1}{2}^\circ$, 4° and 5°) and locomotive tyre wear.

Turning from expenditure on Capital and Renewals Account to current working the concentration of most of the main line engines in general service on two main depots at Atbara and Khartoum has resulted in substantial economies, and by using the caboose system pooling of engines has been avoided. The kilometrage per engine run has been extended and loads increased, the longest run at present being 430 miles, and the heaviest load 1,200 tons. March, 1934, was an exceptionally busy month and the traffic was handled with 45 per cent. less engines and 32 per cent. less footplate staff than had been used for handling approximately the same tonnage prior to reorganisation.

Traffic Operation

In the traffic operating section special arrangements have had to be introduced to ensure that the crossing of the long and heavy trains now being run is conducted safely on a railway where the main line consists exclusively of single track between stations. In common with other countries, the Sudan has felt the world depression and the rating policy of the railway has necessarily called for close attention with a view, particularly, to adapting it to new conditions imposed by falling commodity prices and consequent trading difficulties. The problem is to frame rates sufficiently low to permit the marketing of Sudan produce to give the best working results while avoiding the danger of too wide a disparity between these rates and those for imported goods. The tendency has been to quote flat rates to cover wide areas, thereby assisting the crops grown in the more outlying parts of the country. When it has been inexpedient to introduce

flat rates, efforts have been made towards the same end by the provision of maximum rates. In order to induce better loading of trucks and a consequent reduction in working costs, reduced rates have been extensively quoted in terms of wagon loads.

Passenger traffic has continued to be affected by the general adverse conditions and there has been recourse to cheap fares and improved facilities. In the lowest class, *i.e.* 4th, used exclusively by the inhabitants of the country, the reduction in fares has had to be drastic in order to withstand the onslaught of road transport. Coaches of this class have been improved by better lighting and other ways calculated to give increased comfort.

Publicity

It has been considered good policy to continue and improve on publicity methods both with an eye to the existing conditions and the ultimate object of establishing in the minds of possible travellers, sportsmen and tourists, the Sudan as a country to visit. In this connection a series of coloured posters, depicting native types, has been issued, and attractive illustrated booklets in English and German have been published, together with pamphlets, maps and postcards. It is the intention to improve and extend upon these yearly.

Motor transport competition, while not acute, tends nevertheless to assume serious proportions in passenger and goods traffic. While recognising, in principle, the value of motor transport as a feeder service, consideration has been given to measures designed to keep this relatively new form of transport within a co-operative rather than competitive sphere. The Sudan Railways have the advantage, in the matter of competition by road transport, in that appreciable areas of desert lie between the productive areas and the coast. These desert areas present difficulties to motor transport and steps are being taken by Government to discourage attempts by more resourceful motor transport owners to overcome them. As one means of protecting highly rated traffic, a scheme has been devised, so far on a small scale, which resolves itself into an inflation of certain high rates within the desert areas referred to, with a compensating deflation outside these areas. The deflated rates are such as should place railway charges on more even terms with motor transport charges.

EGYPTIAN DELTA LIGHT RAILWAYS

THE system of the Egyptian Delta Light Railways comprises a network of 2-ft. 6-in. gauge lines serving almost the whole of the Nile Delta, with a mileage of 620. The character of the country is such that the company caters most extensively for agricultural interests, although the most important item of goods traffic has in the past been building materials and stone. Building activity inevitably reflects general economic conditions, so that the tonnage carried under this head during 1933-34 decreased by 38,416. The company was largely instrumental in developing the cultivation of cotton in its zone, a traffic which showed the most substantial rise of any during the past year, increasing by fifty per cent.

Passengers have in the past contributed more revenue than goods, receipts from this source totalling 30 per cent. more than the freight takings in 1931-32, but road competition and the poverty of the populace have combined to bring about severe reductions. The fellaheen now usually walk or ride their donkeys to market up to distances of 15 km. Even so, the accommodation of market trains

may be severely taxed on special occasions, as is evidenced by our illustration on page 42.

Soon after road competition began to make itself felt, the company effectively opposed it by the introduction of Sentinel tractors for passenger working. An experimental unit was introduced in 1924, since when the number in service has increased to 50. The effect of this step has been to increase mileage and reduce coal consumption.

The organisation of the railway is on the departmental system, with three districts, each in charge of a District Engineer, a District Traffic Superintendent, and a District Locomotive Superintendent. The General Manager controls the Engineering and Traffic Departments and a Locomotive Superintendent supervises the district locomotive officers and workshops. Single line working rules over most of the system, and since all trains call at every station, running intermediately at a maximum of 30 km.p.h., fixed signals are considered unnecessary except in special cases, traffic being controlled by telegraph on the line-clear system.

NEW ZEALAND GOVERNMENT RAILWAYS

Improvements in the comfort of passenger rolling stock and the speed of goods services have been notable features of a year which has seen a considerable revival in the New Zealand railway finances

THE past year has seen a notable improvement in the financial position of the New Zealand Government Railways, the net earnings increasing from £850,544 in the previous year to £1,085,558. Still more remarkable are the figures of improvement in the railway position since the principle of board administration and management, freed from political control, was adopted in 1931. In that year the percentage of net earnings to capital invested was only 1.16 per cent.; it is now 2.05 per cent. The percentage of total working expenses to gross earnings has declined from 90.90 in 1931 to 82.86 in 1934, while the net operating earnings per average mile open have been exactly doubled, viz., from £114 in 1931 to £228 in 1934.

Prior to the year just ended, the financial improvement recorded by the board had been secured through cutting costs below reductions in revenue. In the year just ended, however, for the first time since 1929 an increase in gross revenue has been recorded in comparison with the previous year.

During the year 1933-34 the board took over the last section of a new main line, Stratford-Okahukura, which gives direct access between the Taranaki and Auckland Provinces, and a thrice-weekly express passenger service from New Plymouth to Auckland and *vice versa* was instituted. On this line a new type of car, combining a day-section and a sleeper-section, has been introduced in the interests of economical working.

The problem of branch lines was probably the most acute which the Railways Board had to face. Its policy has been one of constructive effort to improve the financial position of such lines by doing all in its power to induce public support and by reducing expenditure. The effect of the measures taken is seen in the fact that the branch lines, which showed an operating loss of £165,718 in 1932, had their working losses reduced to £69,877 in 1934.

Car Improvements

A steady improvement has been made in the standard of comfort provided for passengers. On the Limited (the express which provides the fastest transport between the principal cities of Auckland and Wellington) all sleeping-cars are of the "de luxe" type. Nothing has been spared in the design, construction, and fittings of these cars to provide restful comfort in travel. The day cars, too, have been standardised on the principal expresses with new types of seats, improved lavatory accommodation, and special lighting and heating facilities. There have also been coupé compartments provided in the first-class cars of principal trains making day journeys, for the convenience of private parties. Chair seats have replaced longitudinal on subsidiary lines, and, in general, a marked improvement has been made in the comfort and convenience offered to train travellers.

The installation of ball bearings in the passenger rolling stock has been an important phase of the endeavours that have been made to improve passenger services. With the ordinary type of axlebox, hot boxes are liable to occur, notwithstanding that a high standard of care may be exercised in their maintenance. The inconvenience of delay and disturbance of passengers when a hot box occurs on a passenger vehicle is a serious matter, and one that

the board has been most anxious to avoid. It had been decided, prior to the constitution of the board, that a number of axleboxes of the ball-bearing type should be installed, and the result has amply justified this decision. The first bearings were placed in service late in 1931, and up to the present there have been no delays due to axleboxes running hot on the vehicles that are equipped with roller bearings. Fifty-nine cars have been equipped with these S.K.F. roller bearings to date.

Goods Services

In providing speed in transit and efficiency in eliminating trouble for its customers, the board has carried through an effective policy in its goods services. A good deal has already been done in cutting down day services and substituting night services therefor. This, taken in conjunction with collection and delivery services which the board has developed, provides, in general, a rapid and efficient goods service.

There are express goods services now operating on the main trunk lines in both the North and South Islands. Between such points as Dunedin-Invercargill, Christchurch-Dunedin, Dunedin-Timaru, Christchurch-Timaru, Wellington-Palmerston North, Wellington-Wanganui, and Auckland-Hamilton, goods delivered to the department for transport up to the evening of one day are available at their destination practically at the opening of business on the following morning.

Commercial Developments

A new method of securing business against road competition was successfully tried between Wellington and Palmerston North (87 miles). This was to allow road carriers who could guarantee a minimum of ten 8-ton trucks weekly to hire trucks at a comparatively low rate for the carriage of general merchandise. The carriers are required to load and unload the trucks, the department having no responsibility in regard to checking at either end of the run. The system has effectively eliminated road competition, and the department's net revenue from goods traffic has increased between these points. The system is now being tried out between other important centres.

By buying out a competing passenger road service between Wellington and Wanganui, the board is about to put into operation a co-ordination with the railway services which it trusts will provide, upon a sound economic basis, an efficient service of high standard.

Another co-ordination measure put into effect by the board during the year was the institution of an omnibus service in the South Island, between Edievale and Waipahi, in place of the passenger service given on the Tapanui Branch by mixed trains. As a result, it has been possible to effect considerable economies in working rail traffic on the line, while the omnibus service is already almost self-supporting. This omnibus service makes connections with the express trains operating between Dunedin and Invercargill, and provides a better service for passengers, mails and parcels than was possible by the former mixed train service.

The board believes in progressive publicity methods to make known the railway services available to the public

and to educate the public in the importance of giving support to the railways (in preference to private transport) on national-welfare grounds. Good advertising has helped in securing success, for instance, to many special excursions—arranged usually at week-ends—at low fares; and this feature of developed traffic is one of the most promising fields to be further exploited in the coming year.

Large works at present under way are the Wellington new station, the electrification of the Wellington-Paekakariki line and the completion of the Wellington-Tawa Flat deviation, with a complete re-arrangement of the Wellington yard on recently reclaimed land. A steady policy of bridge renewal and strengthening, rolling-stock improvement, and track and building maintenance, at a high standard of efficiency, is being pursued.

WESTERN AUSTRALIAN GOVERNMENT RAILWAYS

A summary of the railway position with regard to road transport and of the principal works undertaken during the past year

IN common with railway systems all over the world during the past few years, the Western Australian Railways have been materially affected by the industrial depression, and by motor competition.

Western Australia being principally a primary producing country, it naturally follows that until the prices of wheat and other agricultural products return to a normal standard, and having regard to the fact that wheat comprises the largest item of freight transported on the railways, it can be assumed that traffic generally will not increase, but at the same time it can reasonably be expected that it will not be subject to a further decrease.

As regards motor competition, this has gradually encroached on the railways' legitimate business, undercutting the railway charges on the higher rated goods but declining to handle the low-freighted commodities such as wheat, manure, &c., and thereby undermining the basis on which the railway rate structure has been built. During the 1933 session of the Western Australian Parliament legislation was passed to deal with the position. The Act, titled the State Transport Co-ordination Act, was framed with the object of preventing wasteful and unfair transport competition. A board has been appointed to administer the Act, and consists of three members, one of whom (the Chairman) is a representative of the Government, one a representative of city interests and one a representative of country interests. The Act came into operation on July 1, 1934, and although it is too early yet to predict the full effect of its operations, already a considerable number of motor truck owners, working in direct opposition to the railways, have been refused renewal of licences, while a number of feeder services to and from railway stations have been authorised. It is anticipated that the Act will have a beneficial effect on railway finances, and the results of the first year's working under it will be awaited with considerable interest.

On November 3, 1933, a new line between Pemberton and Northcliffe was opened for traffic. The new section, 22 miles in length, traverses the karri forests of the south-west and provides transport facilities for a number of group settlements which have been established in this area. The Government's track mileage is now 4,360.

Construction and Maintenance Work

During the years since 1929, when the financing of any works has been extremely difficult, certain maintenance, which in the ordinary course would have been carried out immediately, was permitted to stand over. A considerable number of engines, wagons and other rolling stock which required extensive repairs were taken out of traffic and stowed until such time as money could be found to restore them to their proper condition. In addition, all works which could be postponed without jeopardising the safety of the system were not proceeded with, and wherever

possible expenditure was curtailed to meet the existing conditions of travel stringency.

It is apparent that such a policy cannot be continued indefinitely without ultimately reaching a stage where the safety of the system becomes a matter of concern. Some twelve months ago it was realised that, although that stage had not by any means been reached, a continuation of the policy of postponement could not be indefinitely prolonged, and it was arranged that over a period of years a programme of belated repairs would be carried out until such time as the system was again up to its normal standard. A commencement on this programme was made during the last financial year, and to date approximately £120,000 has been spent, the work carried out including repairs to engines and other rolling stock, renewal of boilers and engine frames, strengthening of bridges, relaying and reballasting of track, renovation of buildings, &c. It is anticipated that the complete programme will cost in the vicinity of £500,000 and that the work will extend for a further three to four years.

Washaways and their Results

As the result of exceptionally heavy rains during March last, extensive washaways, unprecedented in the history of these railways, were experienced, and for a few days services on practically all main lines were completely dislocated. Partial services were expeditiously restored, but the prolonged and devastating effect of subsequent rain-falls has increased working expenses considerably.

A work just completed, and which will be of considerable importance to the system, is the duplication of a section of track between Swan View and Mount Helena on the main eastern railway. This section, running through the Darling Ranges, provided a bottle neck of single line about 12 miles in length between two double line sections. As the bulk of the traffic from the country areas to the city of Perth and the port of Fremantle had to traverse this section, considerable trouble was experienced in delays to trains awaiting crossings, and although the position was eased by the introduction of automatic signalling some years ago, the difficulty was not wholly overcome thereby. The duplication which has now been carried out will assist materially in the punctual running of trains, and the advantage will become more pronounced as development extends throughout the country and railway traffic increases in consequence.

Little new rolling stock construction has been undertaken during the past twelve months, such work being largely confined to the building of a number of stock trucks and the replacement of a few obsolete wagons with modern vehicles. On account of the age of some of the Department's rolling stock extensive renewals will probably be necessary in the near future, but such will largely depend on the state of the finances and the necessity for additional accommodation to handle traffic.

RAIL MOTOR OPERATION IN QUEENSLAND

Enterprise in the provision of rail motor services has been rewarded with wide public popularity

(See illustrations on page 46)

A FEATURE of railway operation in Queensland worthy of notice is the progress made in the application of motor traction to railway traffic. The rail motor traffic miles run in that State have increased from 628,000 during the year 1929-30 to 1,564,800 during 1933-34 and now represent 14 per cent. of the total traffic train miles. The following brief outline of the experience gained in the development of a form of light traction suitable to the requirements of Queensland may be of interest to those who elsewhere are faced with conditions and problems of a similar nature.

For many years Queensland, having an area five and a half times greater than the British Isles, with a population of less than one million, and possessing 6,566 route miles of railway, more than any State in the Commonwealth of Australia, has been faced with the problem of providing more frequent, quicker and more convenient passenger, parcels, cream and light goods services in areas where the business does not warrant the expenditure that would be involved by an extension of the steam services.

Number of Cars in Service

The endeavours to obtain a suitable form of traction, lighter and more economical of operation than a steam train yet sufficiently flexible in carrying capacity to enable it satisfactorily to cope with any peak loads likely to be obtained, date back to the year 1911, when experiments were first conducted with converted road motor vehicles.

However, it was not until 1927, when the heavy lorry type of engine was introduced, that any really satisfactory progress was made. In that year engines of 45 h.p. were placed in service and so successful was their operation that their use was quickly extended. Experience with these units demonstrated that with more powerful cars it would be possible to utilise motor trains on other sections where the traffic was heavier, and as on certain lines where 45 h.p. cars were in use the traffic was increasing beyond the capacity of these cars, it was decided to introduce cars fitted with engines of 100 h.p. Two of 150 h.p. have also been placed in service so that at the present time Queensland has in service:—

Cars		Trailers	
No.	Capacity h.p.		
40	45	Passenger	73
15	100	Cream	13
2	150	Goods	8
57		Total	94

The number of rail motor services now being operated is 60. The classes of services in which the cars are engaged comprise:—

Branch Line.—Combined passenger, cream and parcels services. Combined passenger and parcels services. Combined passenger, parcels and goods services.

Country Main Lines.—Combined passenger, cream and parcels services. Combined passenger and parcels services.

Suburban Lines.—Passenger services.

In quite a number of instances the motor services have replaced steam train services; in other instances they have been run supplementary to the steam services either to provide more frequent, quicker and more convenient

passenger and cream services or for the purpose of recovering traffic which had been diverted to the roads. The introduction of rail motor services has resulted in the railways:—

(a) Obtaining entirely new traffic, created by the provision of new and improved services.

(b) Regaining traffic which had been diverted to the roads. As a matter of fact in many districts owners of private motor cars are now travelling by rail motors in preference to using their own cars.

Popularity of the Cars

A pleasing feature of the rail motor trains is that in every district where they have been installed they have become most popular with the travelling public, who have been enthusiastic in their appreciation of the quick, clean and comfortable transit provided. More particularly is this so on branch lines on which the passenger traffic has of necessity been catered for previously by mixed trains, due to the business being insufficient to warrant the provision of a steam passenger service.

The popularity of the motor cars has been enhanced by the fact that in their design care has been taken to adhere as closely as possible to that of a road motor coach and an endeavour made to get away from the carriage type of body which had been so largely adopted elsewhere. The driver's seat is on the same level as those of the passengers and no obstruction is caused by the closing in of his compartment, the enclosure being only a low partition and passengers thus have an extensive view of the surrounding country either ahead or to the sides. Rail motor car travel in Queensland, where there are only two classes of travel, viz., first and second, is all charged for at second class fare.

Rail motor services are conducted very much on the lines of omnibus services, picking up and setting down at recognised stopping places. Particularly in country districts, stopping places have been established at many places between stations, e.g., at level crossings, occupation crossings and other places where wicket gates have been provided in fences to give access to the line. This arrangement enables passengers to be picked up and set down at the nearest points to their homes and thus, as nearly as possible, to enjoy the same facilities as are provided by road motor vehicles.

The drivers of rail motor cars are drawn from the ranks of locomotive drivers and before being appointed to the position of rail motor driver are required to pass practical and oral tests given by the rail motor inspector. The guards employed on rail motors issue tickets to passengers joining at unattended stations or stopping places, attend to the receipt and delivery of parcels, loading of cream and assist passengers in joining and alighting from cars. All railcars are operated under block or train staff regulations. When a driver is operating the car alone he is responsible for the observance of the necessary regulations in regard to staff working, protection, &c., but when accompanied by a guard the latter undertakes the usual guard's duties.

The fuel used is a mixture of petrol and power alcohol, the latter ingredient being produced locally as a by-product of the sugar industry. The average petrol consumption and loads hauled by the various types of

cars during the 12 months ended May 31, 1934, are given below:—

Type of Car	Average load, tons	Petrol consumption		
		Miles per gall.	Ton-miles per gall.	Pints per ton per mile
h.p.				
45	14.50	9.80	142	0.056
100	23.75	6.77	162	0.049
150	25.13	5.16	129	0.061

The drivers of rail motor cars perform any necessary repairs or adjustments on the road or at isolated depots, but other repairs are performed by mechanics at running sheds or workshops. The overhauling of the engines is performed by a specialised staff.

To avoid the necessity for the cars being out of service any longer than is absolutely necessary for the purpose of effecting repairs to the engines, spare engines are kept on hand and are sent to the workshops nearest to where the cars requiring attention are stationed. The engines requiring overhaul are there replaced by the spare engines and are sent to the principal workshops for attention.

The costs per motor mile of maintaining and repairing the various types of cars are shown below:—

Type of car	Engine	Bodywork	Total
h.p.	d.	d.	d.
40	0.88	0.52	1.40
100	1.19	0.48	1.67
150	1.70	0.57	2.27

The cost of operating all types of cars per motor traffic mile is:—

	Pence
Running costs, repairs and stores	10.17
Depreciation	1.99
Interest	1.57
Total	13.73

All cars and passenger trailers are fitted with Westinghouse air brake and each car is provided with the following standard equipment:—

- (a) Chemical fire extinguisher in car and trailers.
- (b) Standard breakdown kit, including screw jack, lifting beam, wood saw, hack saw, axe, tommy-bar, &c.
- (c) First aid ambulance box.

In addition to passenger trailers and combination goods and passenger trailers, special trailers for goods and cream have been constructed, whilst on one service the cars haul the lightest type of goods wagons.

VICTORIAN GOVERNMENT RAILWAYS

A survey of recent legislation and technical developments affecting the services of the Government railways in Victoria

IN March last Mr. H. W. Clapp, accompanied by a Special Officer (Mr. R. G. Wishart), left Australia for an official tour abroad, to visit in turn the United States of America, Canada, Great Britain and Europe. The mission is associated with recent important developments in rail, road and air transport and their possible application to Victorian problems. Mr. N. C. Harris has been appointed Deputy Chairman of Commissioners until Mr. Clapp returns.

During the financial year 1933-34 the average mileage worked by the Victorian Government Railways Administration was 4,728, the same as in the previous year.

Transport Regulation

One of the most important developments during the past twelve months from the Victorian Railways point of view, and one that must have far reaching effects on the transportation problems of the State, was the passage by Parliament of a Transport Regulation Act, and the appointment of a board to administer its provisions.

The Act, which became legally operative as from January 1, 1934, establishes the principle of regulation and co-ordination of rail and road transport and provides for the board to consist of three members—a chairman, one member who is a primary producer and one member engaged in commercial pursuits outside the metropolitan area.

Any commercial motor vehicle which was operating a *bona fide* service on any route or in any area in a specified period prior to the introduction of the Bill is entitled as a matter of right to operate upon such route or in such area until December 31, 1934, when the provisions of the Act in regard to the grant or refusal of licences will apply, but notwithstanding that all such vehicles shall be granted licences as a matter of right until December 31, 1934, the provisions of the Act relating to hours of driving, speed

and weight limits, insurance, and payment of award wages, &c., are in force now, although the creation of a policing organisation is incomplete.

Unemployment Relief

In order to alleviate unemployment arising from depressed world conditions, the Victorian Government approved during the past two years of certain relief funds being allocated for various railway works. The amount provided by the Government represented mainly the labour proportion of the cost of the works, the balance being provided by the Railways Commissioners.

Since the inception of the scheme a total amount of approximately £1,235,000 has been expended on railway works for the relief of unemployment. The bulk of the expenditure is being incurred on work in the country, which includes improvements to the track and extensive regrading of lines. Some track improvement work in the suburban area as well as draining of pits between platforms at stations has also been provided for out of these funds. The regrading work will permit of substantial economies in goods train operation, particularly wheat trains *en route* to the seaboard, and the improvements to the track, which consist chiefly of closer spacing of sleepers and additional ballast, will result in reduced maintenance costs.

Welded Track

Further progress has been made in track improvement in the metropolitan area by an extension of the welding of 45-ft., 100 and 110-lb. rails to lengths of 225 ft.

The Thermit process has been adopted and to date the total length of track so welded is 36 miles. In addition, 3½ miles of track welded by the electric arc, and Lindeweld processes have been installed for experimental purposes.

Many 100-lb. rails with over 30 years' service have,

after cutting off the battered ends, been welded and relaid. The same allowance for expansion has been provided at each joint as for 45-ft. rails and this has proved sufficient over wide temperature ranges.

Improved Locomotive Performances

Following on an investigation of the performance of C class 2-8-0 goods locomotives, tests of successive steps to increase their horsepower and efficiency have resulted in appreciable improvements. The first alteration to the original locomotives was the fitting of a self-cleaning type of smokebox. This had the effect of improving the steaming capabilities and at the same time prevented the accumulation of ashes in the smokebox. The height of the blast pipe was reduced and its diameter increased while the chimney was also increased in diameter. In addition 1½-in. elements were replaced by 1½-in., and the disposition of superheating surfaces was modified.

The reduction in pressure drop between boiler and steam chest and the drop in back pressure have combined to raise the horsepower by amounts ranging up to a maximum of 23 per cent. at 36 m.p.h. The engine running schedules on a typical trip, Melbourne-Bendigo (100 miles), have been reduced by 42 minutes in the down and 51 minutes in the up direction. Similar principles are now being applied on A2 class passenger locomotives with very promising results.

Full advantage is being taken of a dynamometer car jointly owned by the South Australian and Victorian Railways in studying the performances of locomotives under varied conditions.

Automatic Couplers and All-Welded Trucks

Steady progress has been maintained in the programme drawn up for the conversion of rolling stock to automatic couplers. To date 33 per cent. of the 622 locomotives and 68 per cent. of the 20,702 trucks have been equipped, and a commencement has been made with the application to country cars.

The advantages of this modern equipment from the operating point of view have already been demonstrated in a spectacular manner by the increased train loads that the couplers have made possible. The previous load limit corresponded with a tractive power of 45,000 lb., but as much as twice the restricted load under the old draw-gear limitations has since been hauled on a double-headed train equipped with automatic couplers. In addition, the vehicular limitation is virtually abolished when sufficient auto-coupled vehicles are marshalled in the leading portion of trains.

Following on satisfactory trials of all-welded construction of the standard "IZ" goods truck—a 27-ton capacity vehicle—170 trucks of this type were recently placed in commission. A start has been made with the building of a further 200. In addition to construction work, the electric arc is being utilised economically to fabricate numerous component parts of vehicles previously manufactured as steel castings.

Faster Services

Accelerated services have been scheduled for additional country lines. To meet the convenience of travellers and to allow of more time for business purposes, the amended timetables provide for later departures from the metropolis. With the exception of one of the Interstate expresses, the earliest departure of an important afternoon train is now 5.5 p.m., whilst the earliest of the morning departures is 7.45 a.m.

On the five lines recently dealt with, the reductions in overall train times range up to 60 minutes for a journey

of 156 miles. A further series of passenger services is now under review, and many improvements have been applied to the more important goods services.

Extensive alterations and additions to this plant are nearing completion. Power is supplied to the township of Wonthaggi as well as to the whole of the mine workings. To meet increased load demands it became necessary to increase the generating plant and to replace Lancashire boilers which had given more than 20 years' service and one water tube boiler in which severe pitting, of a character fortunately not often experienced, had occurred under circumstances difficult of detection. All plant will now operate at 250 lb. per sq. in. and 620 deg. F. instead of 150 lb. per sq. in. and 520 deg. F. The new boilers are Kidwell water tube boilers equipped for burning pulverised duff coal, *i.e.*, the residue from rescreened slack.

The coal handling plant has also been housed in a new building. An all welded bunker of 125 tons capacity is fed by an automatic skip hoist arranged to deliver coal to a belt conveyor running along the top of the bunker. The action of the complete unit is entirely automatic. Modern ash handling equipment has also been included. A new 1,875 kW. turbo-generator has been installed and the switchboard has been completely rebuilt and new transformers provided. With all the new equipment in operation appreciable economies will be realised.

Victorian and Melbourne Centenary

In October, the Centenary of the State of Victoria and its capital city was celebrated. For some months a widely representative Council had been active in arranging a comprehensive programme of functions and fixtures, pageantry and carnival fittingly to celebrate the State's 100th birthday. The celebrations which were opened by H.R.H. the Duke of Gloucester and which many visitors from overseas will attend will continue until March, 1935.

Worldwide publicity has been given this outstanding event in Victoria's history, and at the time of writing there is every reason to believe that there will be a record influx of visitors from overseas as well as from the other Australian States. In addition to a 1,500 miles tour of the Royal Train embracing many districts in the State, a wide range of Reso and other small rail tours has been arranged. With concession fares which all the Australian State and Commonwealth railways are granting it is anticipated that the railway systems will be confronted with a passenger transportation business greatly exceeding any previous peak.

The latest report, which covers the year ended June 30, 1934, shows that total earnings were £9,175,111 against £9,446,121 for the previous year, and that the figures for both years included sums received from the Government in respect of the loss on working certain lines. A decrease of £137,625 in railway working expenses was secured notwithstanding that awards of the Arbitration Court and Railways Classification Board increased the wages of the staff by approximately £60,000. Railway net revenue, at £2,798,700, represented 3.69 per cent. on railway loans, but this was insufficient by £735,119 to meet interest charges and exchange on interest payments and redemption, although there was a saving of £90,682 in interest charges and exchange in respect of all services compared with the previous year. A reduction of the railway capital is again advocated by the Commissioners. The continuance of the fall in railway revenue since 1928-29 is largely due to low prices for primary products, diminished purchasing power, and unregulated road services. In order to stem the drift, the system of freight contracts at much reduced rates for the carriage of higher class goods to a large number of localities is being extended.

CANADIAN NATIONAL RAILWAYS

Co-operative economies, such as the pooling of passenger train services and collaboration in operating routine, are helping the Canadian railways to fight depression

THE greatest problem affecting Canadian railways at the present time is the unprecedented reduction in gross revenue brought about by four years of continuous decline in business conditions. The curtailment of revenues has also been affected by increasing motor vehicle competition by a transportation agency which does not contribute its fair share of the cost of the highways.

The effect of the business depression on the revenues of the Canadian National Railways is shown by figures for the years 1928 to 1933 inclusive:—

	Railway operating revenues	Decline from 1928	
		Amount	Per cent.
	\$	\$	
1928	312,286,000	—	—
1929	299,232,000	13,054,000	4.2
1930	250,968,000	61,318,000	19.6
1931	200,505,000	111,781,000	35.8
1932	161,104,000	151,182,000	48.4
1933	148,520,000	163,766,000	52.4

In other words, for every dollar of revenue earned in 1928, the Canadian National obtained only 48 per cent. in 1933.

Measures of Economy

Such severe curtailment of revenues has necessitated drastic measures of economy; as examples of the form which these economies have taken may be mentioned reductions in rates of wages of all employees, cancellation of passenger train services to the extent of over one-third as compared with 1929, closing of agency stations and co-operative measures with the Canadian Pacific Railway, to which reference will be made later in this article. In fact a continuous effort to reduce expenses has been carried on, bearing in mind the necessity of maintaining essential services to communities served by the railway.

These economies are partially reflected in the reduced number of employees and payroll figures. The average number of employees in 1933 was 70,625 with a total payroll of \$95,632,000 and this represents the lowest level ever attained in the history of the consolidated enterprise.

Negotiations with various groups of organised labour leading to further reductions in wages were carried on. The result of wage reductions is that, generally speaking, the organised employees are now on a 15 per cent. deduction from the standard rate basis. The reduction in rates of pay of the supervisory and executive staff averages somewhat higher than this, ranging upwards with the higher rated classes.

Notwithstanding the drastic nature of the reductions in expenditures the operating efficiency of the Canadian National Railways has improved. A comparison of a few of the more commonly recognised indices of opera-

ting performance in 1933 with prior years is shown below:—

	1933	1932	1929	1923
Gross tons per freight train ..	1,512	1,461	1,476	1,304
Net tons per freight train ..	632	621	641	590
Gross ton miles per freight-train hour	23,960	23,133	19,740	15,211
Freight train miles per freight-train hour (speed)	15.8	15.8	13.4	11.7
Fuel consumed per 1,000 G.T.M. (lb.)	118	118	125	148
Fuel consumed per passenger car-mile (lb.)	13.7	13.3	13.2	15.3

These somewhat technical figures, which incidentally parallel the experience of many of the larger systems on this continent, reveal an increasing operating efficiency in spite of the disturbed conditions brought about by the depression.

Practically no capital expenditures have been made for extensions to the property during the past few years; only such general additions and betterments as were absolutely essential for safety were undertaken during the period.

During 1933 signs of abatement in the persistent decline in revenues were apparent; from August, 1929, to July, 1933, the railway had experienced a continuous decline in the revenues of each month as compared with the preceding year; however, commencing with November, 1933, monthly revenues have shown an increase over each of the corresponding periods in the preceding year. Present indications are that 1934 revenues may be slightly greater than those of 1932.

The question of competition from other forms of transportation has been constantly under study by the officers of the railway. Particularly is this true of motor truck competition, which has been and is receiving very active attention. In an endeavour to regain freight tonnage lost to motor trucks, the railways have been experimenting with reduced freight rates which include door to door service. Undoubtedly some traffic has been regained by the railways through these efforts. The problem will not be solved, however, until highway transportation competition has been placed on a more equitable basis, by motor vehicles, particularly motor trucks, assuming their proper share of the economic cost of the highways.

Pooling Arrangements

In accordance with the expressed desire of Parliament, the managements of the Canadian National and Canadian Pacific Railways took action in November, 1932, towards effecting co-operative economies before the enactment of the Canadian National-Canadian Pacific Act of 1933. For this purpose a Joint Executive Committee consisting of the executive head and two directors of each railway was organised. This in turn appointed a Joint Co-operative Committee consisting of three technical officers of each company with power to investigate the details of specific co-operative proposals relating to railway activities. Other special committees were appointed to deal with co-operative measures in regard to express and

telegraph operations. Results so far accomplished are evidenced in the pooling of passenger train services between Montreal and Toronto, Montreal and Quebec and Ottawa and Toronto. Other economies have resulted from arrangements for joint operations such as switching, car cleaning and freight shed operation at a number of points where duplication existed, as well as the hauling of traffic by one railway for the other. Many similar projects are under study, which, it is anticipated, will result in mutual benefits to both companies.

There are distinct signs that the bottom of the depression has been passed and that the years ahead will be years of continued recovery with a return to sane prosperity. Better business conditions are producing substantial increases in traffic on the Canadian National Railways to which it is encouraging, and a sign of the wisdom of the steps taken, to note that the system is responding with substantially increased net earnings. Scenes on the Canadian National and Canadian Pacific systems appear on page 47.

PALESTINE RAILWAYS

Constructed largely for military purposes or pilgrim traffic, the railways of Palestine face present-day conditions with several initial handicaps

IN the management of the railways entrusted to it the Palestine Railways Administration has to face unusually complicated conditions. Its route length of 983 km. is divided between two gauges—the 4 ft. 8½ in. in the Mandated Territory of Palestine and in the Egyptian territory of Sinai, and 3 ft. 5½ in. (105 cm.) on the two sections of the Hedjaz Railway which are respectively in Palestine and in Transjordan Mandated Territory. There is also a divided ownership, the standard gauge railways in Palestine (known as the Palestine Railway) belonging to the Palestine Government and the railway in Sinai (El Kantara-Rafa) to the British Government. The two sections of the Hedjaz Railway are connected by a link in Syria belonging to and operated by the French authorities. No interest or sinking fund charges are payable in respect of the El Kantara-Rafa or Hedjaz Railways.

Financial results of the Palestine Railway for 1933-4 showed a great improvement on previous years. Whereas the total ordinary working expenses were £P.3,294 less than in the previous year, the revenue increased by no less than £P.78,305 or 22 per cent. As the result of the greatly increased traffic there were increases in expenditure in the running section and in transportation expenses, but economies were effected in other directions, principally in the engineering branch. The operating ratio was reduced from 71 per cent. to 57 per cent. After taking into account the expenditure of £P.4,377 on extraordinary works, the contribution of £P.40,000 to renewals fund, and the payment of £P.156,458 in respect of debt charges and sinking fund, there was a deficit of £P.15,660 only, as compared with £P.116,673 in the previous year. Passenger traffic increased 7.5 per cent. and goods traffic 12.1 per cent. Tourist traffic, though slightly better than in the previous year, is still disappointing. The arrangements for the through service by rail from Egypt to Haifa and by road from Haifa to Syria were continued during the year, but there was some falling off, caused partly by greater competition by sea and, probably more largely, by the less satisfactory manner in which the road portion of the service was operated.

El Kantara is on the eastern bank of the Suez Canal and communication with the Egyptian State Railways on the western bank is provided by ferries. At Rafa the 203 km. of this railway connect with the main line of the Palestine Railway (226 km.) from Rafa to Haifa, which has a branch of 87 km. from Jaffa to Jerusalem.

The standard-gauge railways from El Kantara right through to Haifa were constructed somewhat hastily during the war, mainly for military purposes. They are in consequence unsuitably equipped for commercial requirements,

and they also do not serve the most favourable routes. Originally belonging to a French company, the Jaffa-Jerusalem line was constructed on the metre gauge and opened in 1892. It was converted by the Turks during the war for military reasons to the 105 cm. gauge, and later by the British military authorities to standard gauge. It was acquired by the Palestine Government after the war by payment of compensation to the French company. Money for improvement of these standard gauge lines is scarce; there are still too many locomotives in bad order, partly due to the quality of the water supply; and the proper maintenance of track and bridges is a serious problem.

The Hedjaz Railway

The Hedjaz Railway, now 467 route-km. in length, was built before the war largely by Turkish military labour and financed by contributions from Moslems throughout the world with the primary object of conveying pilgrims to Medina and Mecca. In Palestine it has two separate termini at Haifa and Acre and joins up at Samakh with the railway from Damascus in Syria, which connects at Deraa with the railway of 323 km. in Transjordan to Nassib, Amman, and Maan. This Transjordan line formerly continued southwards for 113 km. from Maan to Mudawara on the border of Transjordan and the Hedjaz and thence to Medina, but this southerly section has not been re-conditioned since the damage done during the war, and is not in use. The large pilgrim traffic which formerly used it has entirely ceased. As a military measure the Turks constructed in Palestine during the war the railway of 38 km. from Nablus to Tulkarm, which is now included in the Hedjaz system. The 60 km. section from Affula on the Haifa-Samakh line to El Mas'udiya near Nablus was closed in 1932 owing to lack of traffic, but has not yet been removed. The Hedjaz Railway, which was originally built for commercial (mainly pilgrim) traffic, is in fairly good order.

New workshops with dual gauge approaches have been brought into use at Haifa, in place of the old main workshops there, and of the sub-shops at El Kantara East, which had been constructed by the military authorities. The locomotive position will not, however, be entirely satisfactory until the new water-supply planned for the town of Haifa is made available. Engine failures are still frequent in consequence of bad water and time-keeping is often unsatisfactory. Tourist traffic still remains affected by the economic crisis, and road competition has continued to make inroads. This competition is now being met with success on the Jaffa-Jerusalem line which formerly suffered in particular from the fact that it is paralleled by a good road.

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